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September 17, 1931

Structural Welding Committee Presents Report of 5-Year Investigation

Practices and Trends in Brick Distribution

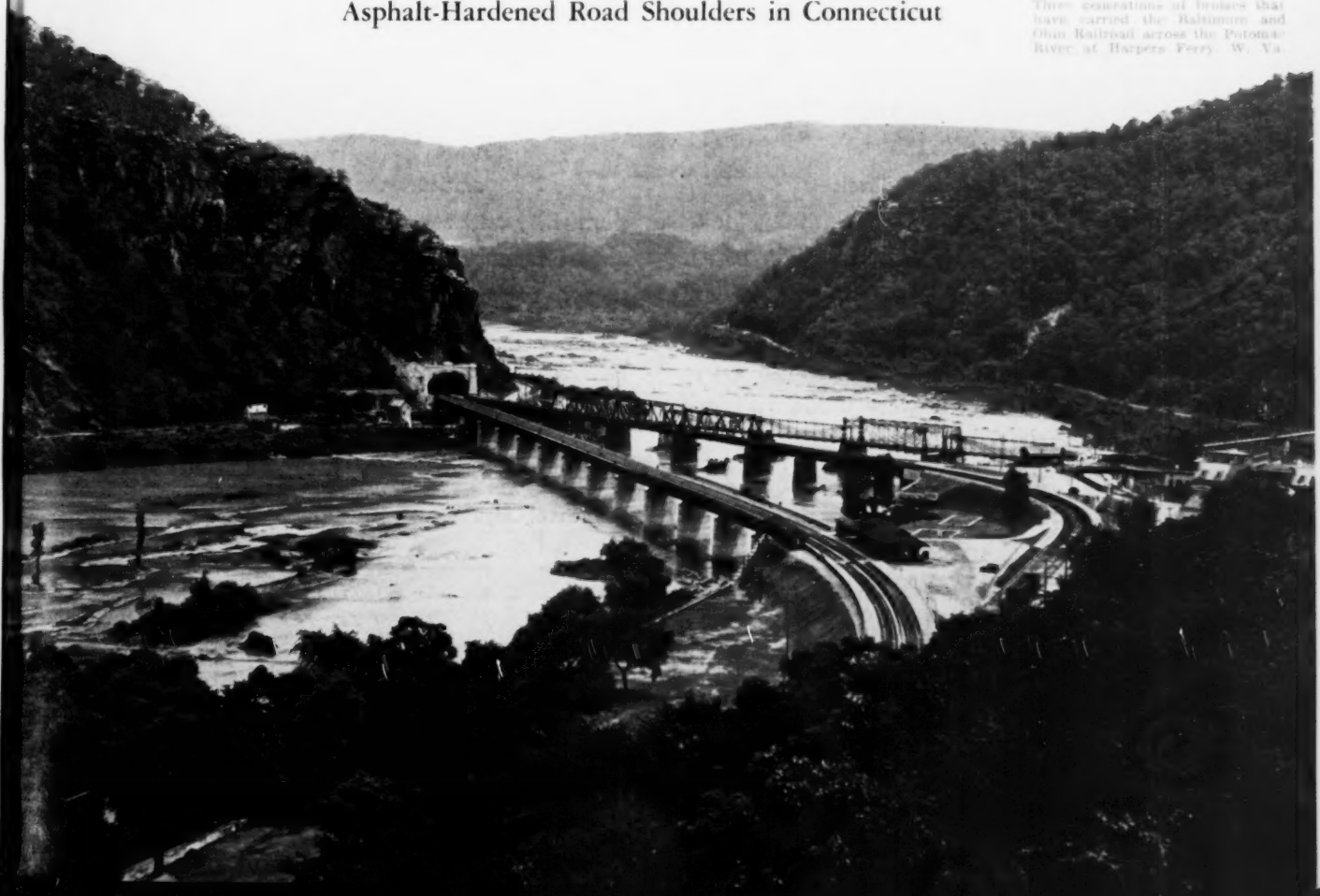
Ninety-Four Years of Bridges at Harpers Ferry

Handling 154-ft. Plate Girders in Toledo Bridge

Design Characteristics of Clamshell Buckets

Track Elevation and Relocation in Dayton, Ohio

Asphalt-Hardened Road Shoulders in Connecticut

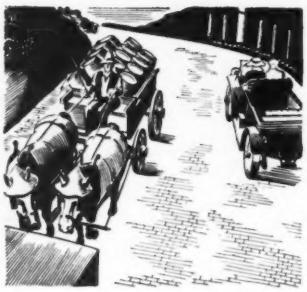


Three generations of bridges that have carried the Baltimore and Ohio Railroad across the Potomac River at Harpers Ferry, W. Va.

28 Years *then Relaid with over 100% Salvage*

Lameuse Street, Biloxi, Miss. — Paved in 1896, relaid in 1924.

OVER A QUARTER of a century of service from a brick pavement. Then the bricks were taken up and relaid with more than 100% salvage! It sounds almost unbelievable, doesn't it? ♦♦ Here is the story. Lameuse Street in Biloxi, Mississippi, was paved in 1896 with 2½" x 4" x 8½" brick laid to a 4" depth. When it was relaid 28 years later the brick were turned so that the thickness was 2½". The salvage, therefore, was more than 100% and the surplus brick were used in a block of new pavement. ♦♦ This amazing pavement record is only one of hundreds which have been chalked up to the credit of brick.



Brick pavements endure. Not one has ever worn out from the top down. When they must be replaced (due ordinarily to the failure of the base) the brick can be turned over and will last indefinitely. ♦♦ For smoothness, beauty, safety, durability and economy specify brick, the oldest successful pavement and the most modern of them all.

•

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ENGINEERING NEWS-RECORD

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F. E. Schmitt, Editor

SEPTEMBER 17, 1931

✦

Winter Road Work

IT IS hard," said the officials of one state highway department when interviewed last week about the prospects of winter road work for unemployment relief, "to find enough road work that can be done throughout the winter." These words are discouraging, for road improvement is one of the major items in the list of useful work prospects. Fortunately, better assurance was given in another state, not far away: "There is plenty of work that can be done on the roads this winter, if they will give us the money!" In that state the authorities are planning actively to improve a large mileage of secondary roads to provide winter work. Similarly a third state sees larger winter possibilities in the road field, and is preparing to let several million dollars worth of bridge work, to be completed by spring. A fourth state will put more than a thousand miles under improvement maintenance this winter, providing work for many thousands of men. The evidence strongly supports the belief we have expressed in recent issues, that winter road work can be found in large volume and made available during the coming season to put idle men to work. Funds, and a will to find the work, are the first essentials.

Planning Too Slow

ONE further essential of success in utilizing road work to provide jobs this winter is adequately organized planning. Most highway departments are trying to do the work with their normal forces, and this is obviously impossible. No provision has been made for increased engineering staffs (or else separate emergency engineering staffs) to do the high-pressure location and planning work which the situation demands. Administrative officials seem to believe that any amount of engineering planning can be done by the regular staff if it will speed up and work hard; and quite naturally these officials, under severe pressure to reduce budgets, are disinclined to increase their governmental organizations except for the most compelling reasons. Such reasons have not yet become evident to them, it seems. Hence overtime and overstrain prevail in the engineering organizations that are trying to lay out a largely increased winter program. These conditions involve grave risk that the whole relief-work plan will fail. The necessary volume and speed of work can be obtained only by energetic development of a largely increased engineering organization, one that in size and administrative management is fitted to the urgency of the task to be accomplished. To perceive this need and act without delay to authorize the necessary expansion of planning staffs is the first duty of governors, county commissioners and others who bear the ultimate responsibility for enabling their unemployed to earn a living during the winter.

Named-Road Rackets

ACTIVITY in promoting named highways, which largely ceased a few years ago with the adoption by states and the federal government of numbered routes, is being renewed in several sections of the country. The procedure shows few changes from that of older days, when trans-state and trans-nation highways with historical names threaded the country (on paper) in every direction. In brief, representatives of some self-constituted body, armed with maps and prospectuses, approach local chambers of commerce and other business and social organizations in the communities along the route and solicit financial and promotional support. This is secured in proportion to the selling abilities of the advance agents. It seldom amounts to enough to guarantee any material accomplishment, but it is enough commonly to require counter action by the state highway officials to quash the propaganda. There is no occasion today for road promotion outside of the constituted public roads authorities. They are as sensitive to real needs and as amenable to public wishes as any extraneous organization is likely to be and far more able to bring about their successful realization. Most of the named-road propaganda comes near to being a plain racket.

Continuity in Public Services

WHEN sudden disaster visits a community, as in the storms that ravaged the Caribbean region last week and wrecked Belize, one can hardly escape the apprehension that his home community may some time suffer catastrophe. Since earliest days cities have been subject to destruction from storm, flood, fire or earthquake, and now that we depend in mass on highly organized human works the possible effects of such visitations are vastly magnified. Do these works contain adequate elements of protection against disaster? In the strength of our structures we are progressing toward reasonable safety. But the modern city is less concerned in the fate of an individual structure than in the survival or interruption of its public services. Most disasters of the past became greater calamities because some or all of the services failed to continue in their functioning. At San Francisco, in 1906, the water failed, and so fire was able to wreak more havoc than the earthquake. Twenty years later, however, the hurricane-swept city of Miami was spared a great extension of its suffering by survival of its chief services—water, electric and railway. Every new disaster therefore is significant as a reminder of the

compelling importance of assuring continuity in public services through all contingencies. No other construction of human hands is subject to this dictate in the same degree. It is well for every community to ask whether it has adequate protection, whether its public services have the greater safety margin, the stronger assurance of resistance to every possible cause of interruption, that the security of its inhabitants demands. Considerations of cost or practicability should never be allowed to limit these safeguarding provisions; even the poorest community cannot justify the lessened security. For public services everywhere, whether in large or small, rich or poor community, unquestioned continuity of its vital services through every conceivable hazard is the basic axiom.

Bridge History

THE history of engineering may often be read in structures still standing. This is in many respects an important advantage; at least it has not been conducive to the publication of books designed to debunk previous historians' works, as has been the case in some other fields. In this issue the story of the Potomac River bridges at Harpers Ferry during the past century furnishes stimulating reading for the student of bridge engineering. These structures, particularly during the period of the Civil War, existed against a backdrop of political events that adds much to their interest. The bridge engineer of the day had to contend not only with the forces of nature but also with man-made forces of war. Several times his structures were wrecked by the latter, but always to rise again, until today three bridges, representing as many periods of bridge history, are standing and in use. The latest of these is just completed, after suffering a disastrous fire during its construction stage, a grim reminder of the vicissitudes through which its sister structures passed. In many other parts of the country, too, notably Pennsylvania and New England, the old wooden bridges recall a period in bridge history no less brilliant than the present. All of these old structures invite inspection whenever possible, for they are fast disappearing. One of the satisfactions of being an engineer is the privilege of building for posterity. It is no less a privilege to be able to appreciate the structures of ancient origin, and to be instructed by their example.

Waste of Time

SOMETHING that has been pointed out many times in the past still bears repeating—namely, the lamentable waste of time and interest caused by inefficient management of society meetings. During the recently ended convention season this bad effect was particularly obtrusive because of the intensely serious and practical atmosphere that pervaded most technical society meetings—an expression of the economic stress that motivated those attending. In many of the meetings, just as in the year-by-year routine of previous meetings, it seemed as though waste of time and energy was the most characteristic fact. When the proceedings dawdle and drag along, when speakers are permitted to indulge in boresome recitals of tabulated detail, when they read involved essays instead of presenting a pointedly oriented and summarized statement of facts, or when tedious and trivial society business is pushed into the most important part of the session period, dulling the alertness and interest of the hearers, most of the potential value of the meeting is destroyed. In nearly all instances the essential blame is on the chairman of the meeting, who fails to use good judgment or to control the speakers. A training course for chairmen might help to remedy this condition. At all events, if the work of technical societies is to be made valuable and productive a spirit of efficiency and drive and sure-handed control on the part of presiding officers must be introduced. That spirit is now usually absent, and in consequence truly effective joint thinking of the assembled group is but rarely obtained.

A Welding Magna Charta

PUBLICATION of the report of the structural steel welding committee of the American Bureau of Welding is an event of much consequence. The investigation upon which the report is based provides structural welding with a firm foundation and in addition should go far to refute the charge that welding is a highly variable and uncertain method of joining structural steel parts, in nowise comparable to riveting. Both the plan and the results of the investigation are significant and important.

The idea for a broad program of research was conceived a number of years ago and urged as a necessary preliminary to the safe and proper development of the welding art. One of the results of the present report is to reveal the cohesive and comprehensive nature of that program and the thorough manner in which it has been carried out. In its conception and execution this investigation has seldom been equaled in the field of industrial research. Six years ago, when the first plans were being made, welding, while recognized as a process of potential value to the structural engineer, was barely more than an experimental element of structural practice. In an earlier age a new method such as this would have been left to work out its own salvation by trial and error. Riveting is an example of a process that developed almost wholly by such means. But the modern scientific mind is attuned to a faster pace. Accelerated experience was required, and the sponsors of the welding research set out to supply it. As a consequence, engineers have available today welding design data as extensive as would have been collected in a lifetime of trial-and-error use.

What has the investigation accomplished? In so far as stresses are concerned it supports those in accepted use as safe and reasonable, adding the important admonition that bending stresses should be provided for, or else avoided by eliminating eccentric conditions at the joints. No results were obtained that would justify different working stresses for welds of different sizes. Fillet welds placed transverse to the line of stress were shown to be 35 per cent stronger than those that were parallel. No harmful effects on the base metal from the welding heat were disclosed. All fusion welding processes displayed equally good results. Stringent qualifications for the welding operators were shown to be absolute necessities. Aside from these detailed technical results, the most important revelation is the indication that acceptable welds may be expected from any good fabricating shop; in the investigation work the welds made by 39 fabricators varied at most only 12 per cent from the average strength obtained by all fabricators.

This latter conclusion is perhaps the most important that came out of the research, for knowledge of the uniformity to be expected in commercial practice is wholly new and will have a profound effect upon the

future growth and acceptance of welding by structural engineers. Once this acceptance has become general, the fabricating shops, which have often shown somewhat less than academic interest in the commercial development of structural welding, may be expected to lend a helping hand. It should not be a long step then to the institution of needed further research.

Welding is a method of such vast potentiality that it deserves the support of all branches of the civil engineering profession during its development stage. It is neither necessary nor proper to view it as a process that will entirely eliminate riveting, and thus scrap a huge investment in fabricating machinery. In the minds of many engineers, welding has been accepted as a companion piece to riveting. Its development should be fostered strongly and continuously with that end in view. The report of the structural steel welding committee provides a basis and an impetus for this development in both its commercial and research phases.

Genius in Road Development

IN THE splendor of the late summer season the new worlds opened up by the modern road system exert their most compelling fascination on the road traveler. And in that experience one cannot fail to be deeply impressed with what the highway engineering art has accomplished. Hats off to the roadbuilder!

In the short fifteen years or so since the active beginning of road modernization he has, in his best roads, been wonderfully successful in fitting the roadbed to the safe speed of travel. This, too, in the face of ever-increasing speeds, which he hardly could foresee. He has anticipated the needs of later years with remarkable precision. The night driver is able to appreciate this best of all. Skillful location and design supplemented by refined construction have produced main roads that come reasonably near to giving the utmost in safe transportation.

Just how this close adaptation to practical travel needs was achieved is not wholly clear. Many of its elements go well beyond computation or the application of standards of grade and curvature. Intuitive judgment evidently was a commanding factor. Smoothness, easy transitions at critical points, center and lane marking, signals, are coupled with well-adjusted banking, good sight distances and effortless alignment and profile; and the composite is not a mere mechanical trackway but blends effectively with the landscape.

There is further need for the same genius that wrought these results. Perhaps the need is greater, for each succeeding step toward perfection is harder than the last, and perfection rises each day to a higher standard. We still need, for example, to learn how to make and hold shoulders safe; we must provide passing sidings, assure safety at intersections and special hazards without throttling traffic by stop-and-go control, and above all to make the road visible. Darkness and blinding glare are among the greatest of present hazards. If some of these problems depend largely on the work of others, as of lighting experts, yet the highway engineer is their responsible leader.

While we pay tribute to the roadbuilder's past achievements, those same achievements give assurance that he can deal with the problems of today and tomorrow. If his efforts be not discouraged and repressed, the advance yet to come will stand worthily alongside that of the past.

Progress by New Thought

ONE of the strange developments of recent years is a tendency to stop and wonder, and raise the question whither this advancing civilization is moving. The answer, of course, is: Forward! Yet timid minds on many occasions have expressed alarm over the rate of this onward movement, and have deplored the constant change in conditions and habits. They would like to petrify the world. One went so far as to ask for temporary cessation of invention and research. In milder form the same heresy was expressed only last week in a public address by the president of the Chamber of Commerce of the United States, Silas H. Strawn, who charged engineers, scientists and research workers with a share in bringing about the 1929 collapse by not "gearing down our excess productive capacity," so that "now we find ourselves in the position of having developed productivity away beyond consumptive power."

In sharp contrast to such notions, the current depression is bringing out much evidence to show that we suffer not from progress but from lack of progress—from absence of new things and new methods rather than excess. It is a corollary of this observation that the path to new progress and new prosperity lies along the road of original, creative thinking to develop better tools and conveniences for the world. We will progress only by thought and hard work.

Men need new and better things as greatly today as two years ago, or five or ten years ago. A manufacturer in Milwaukee has just proved this by displaying a new milling machine. Four times as many came to see and examine it as had been counted on; interest was intense, despite extreme heat. He will doubtless reap the reward of his pioneering. But his is not the only experience: others have found the same thing during the past year or more. Any industry, any manufacturer who developed a real advance, a better product or better methods found that the apparently dormant buyer-interest readily wakens. The best results of the past year were achieved by those who offered the world something new and better.

It has been truly said that intervals between periods of prosperity are the times of creative thought and development. Progress is the result of dissatisfaction, which brings forth new wants and new efforts to supply these wants. It is in conflict with the static satisfaction that is content to produce accepted standardized articles—to produce, but not to create. Looking back only a short distance, one can see that the once new things, even the automobile and the radio, had reached a point of relative stagnation, and their manufacture settled down to the doubtful level of increasing mass production to supply wants already well filled.

Many people are convinced today that such stagnation was a contributing factor in preparing for the collapse, the effects of which are now troubling us. Increasing supply became out of phase with decreasing demand. The pressure to sell encountered an increasing lack of interest on the part of the buyer. Credits were called upon for aid, and bad trade practices developed—all helping to overturn the balance.

Creative thinking and hard work, we repeat, mark out the road to new advance. There is no hope in standardization of thinking, or even in excessive standardization of types and forms. Perhaps the intensely active standardization that marked the last decade brought evil with its good, by tending to suppress free and original thought. Progress requires a willingness to cast off the familiar tool and to learn how to use the new.

Strength of Structural Welds

Five-year research program of American Bureau of Welding in which 2,500 specimens involving 55 forms of joints were welded by 39 fabricators and tested in 24 laboratories justifies present accepted working stresses and indicates that satisfactory uniformity may be expected in the strength of welds made commercially by any reputable fabricator

By H. M. PRIEST

Vice-Chairman, Structural Steel Welding Committee, American Bureau of Welding and Assistant Engineer, American Bridge Co., New York

Foreword

The structural steel welding committee of the American Bureau of Welding has recently completed its report of the extensive investigation that it has carried out during the past five years. H. M. Priest, vice-chairman, has been requested and authorized to prepare this digest of the report. Such a condensed summary will give the busy reader the essential findings of the committee, but much valuable information of both direct and collateral nature has necessarily been omitted. For those who are particularly interested in the subject of structural welding, the complete report, covering over 200 pages, will be found useful and instructive. Copies may be purchased for $1 from the American Welding Society, 29 West 39th St., New York City. LEON S. MOISSEIFF,
Chairman, Structural Steel Welding Committee American Bureau of Welding.

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Introduction

DURING the World War and in succeeding years the art of welding developed rapidly in such fields as shipbuilding, pipe work, pressure vessels and machinery. The notable success that attended these applications of welding led to a consideration of the suitability of welding processes (particularly fusion welding) to the field of structural steel. The increasing interest in this method of construction gave rise to an insistent demand from designers, fabricating shops and building department officials for authoritative unit stress values that could be applied to the design of any structure to be welded by any responsible organization.

As an answer to this demand, the structural steel welding committee of the American Bureau of Welding[1] was organized in the fall of 1926 for the primary purpose of obtaining reliable information upon which safe unit working stresses for welds could be based. A preliminary survey of existing test data, which were found to be very meager, clearly pointed to the need of a comprehensive series of tests before recommendations could be promulgated. Under the chairmanship of the late James H. Edwards, chief engineer, American Bridge Co., such an investigation was planned and undertaken; to his sane views and to his insistence on adhering to the essentials of the problem may be attributed much of the success of the committee's program.

[1]The American Bureau of Welding is an advisory board on welding research and standardization of the American Welding Society and of the division of engineering of the National Research Council.

The principal objects of the investigation were the determinations of:

1. Safe design values under static loading for various types of fusion welded joints as commercially welded in structural steel fabricating shops.
2. The degree of uniformity in the strength of welded joints that may be expected from such shops throughout the country.

In order that the results of the investigation would be thoroughly representative of commercial practice, a large number of shops were invited to participate. To insure the maximum uniformity of procedure in the conduct of the tests, comprehensive instructions were prepared covering all details from the selection of the welders to the preparation of test reports by the cooperating laboratories.

Scope of Program

The program, as carried out, included the welding and testing of 1,098 specimens in connection with the qualification of the welders and 1,395 specimens in connec-

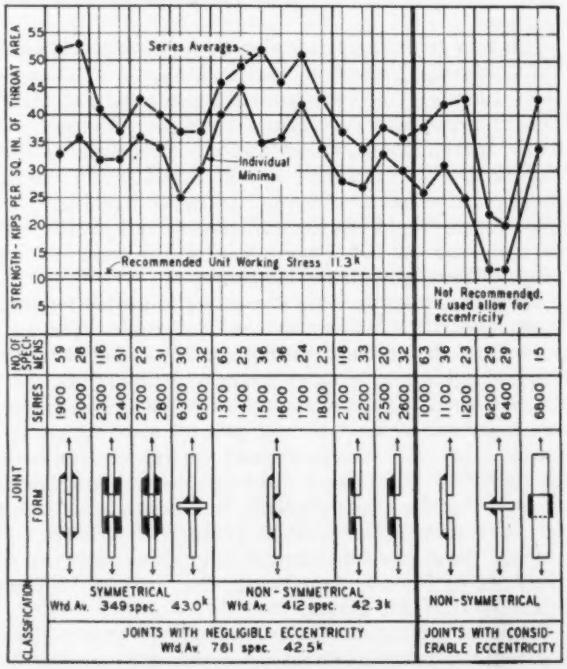

STRENGTH - KIPS PER SQ. IN. OF THROAT AREA
Series Averages
Individual Minima
Recommended Unit Working Stress 11.3k
Not Recommended. If used allow for eccentricity
NO. OF SPECIMENS
SERIES
JOINT FORM
CLASSIFICATION
SYMMETRICAL Wtd Av. 349 spec. 43.0k
NON-SYMMETRICAL Wtd Av. 412 spec. 42.3k
NON-SYMMETRICAL
JOINTS WITH NEGLIGIBLE ECCENTRICITY Wtd Av. 761 spec. 42.5k
JOINTS WITH CONSIDERABLE ECCENTRICITY

Fig. 1—Types of fillet-welded specimens and test results
As structural joints utilize fillet welds almost exclusively, most of the specimens were made with that type of weld.

tion with the investigation proper, the latter involving 55 elemental forms of joints in 169 sizes. Each form of joint was designated by a series number. Within each series were several specimen groups that differed from one another by variations in the sizes of the bars or of the welds.

The participants in the investigation included three steel mills, 39 fabricating shops, 61 welders, 18 inspectors and 24 testing laboratories. The work was distributed over the central and eastern portions of the United States.[2] The University of Toronto provided pilot or preliminary information based on the testing of 342 specimens welded in three Canadian shops.

In the design of the program specimens it was the intent to proportion the specimens so that failure would occur in the weld and thus indicate weld strength. For check purposes a few groups were included that were expected to fail in the base metal. As fillet welds are used almost exclusively in structural joints, the majority

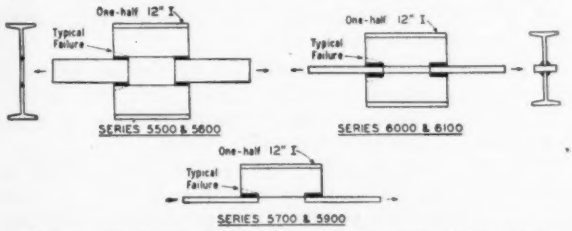


Fig. 2—Specimens designed to simulate plate-girder joints
Series 5500 and 5600 typify a web splice and Series 5700 to 6100 a connection of web to flange.

of specimens had fillet welds. The various forms of fillet-welded specimens are shown in Figs. 1 and 2. The butt-welded specimens included welds of varying sizes and lengths, both continuous and intermittent. A special form of diagonal butt joint is shown in Fig. 3.

Specific but usual limitations were imposed as to grade and thickness of base metal, qualification requirements and manner of loading the specimens. The investigation was restricted as follows:

Base Metal:
Grade—Open-hearth structural steel for buildings, A.S.T.M. A-9.
Thicknesses—¼ in. to 1½ in.
Widths—3 in. to 11½ in.

Filler Metal:
In accordance with American Welding Society specifications.
Bare arc-welding electrodes, E1A, E1B.
Bare gas welding rods; minimum tensile strength of deposited metal, 56 kips[3] per sq.in.

Weld Sizes:	*Weld Lengths:*	*Loading:*
Fillet—¼ in. to ⅝ in.	2 in. to 12 in.	Static
Butt—¼ in. to 1 in.		

Before any welding was done on the program specimens each welder was subjected to definite qualification tests under the supervision of a competent inspector. The mandatory tests were as shown in Figs. 5A (wedge test) and 5B (tension test). The wedge test provided a rapid, inexpensive and excellent test for examining the weld metal and the degree of penetration when the plates were forced apart by driving a wedge between the bars at the unwelded end until the weld ruptured. The tension test provided quantitative results of the welder's ability. Three plates were welded in a flat position and two in a vertical position, making a total of five plates from which test coupons were cut, as indicated by the dotted lines (Fig. 5B), and the weld metal was ground flush. In order for a welder to qualify, his coupons were required to show the following strengths per square inch of weld throat:

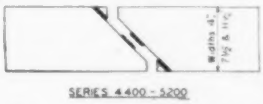


Fig. 3 — Failure of butt-welded specimen subjected to both tension and shear

Arc welds—An average of 45 kips, with a minimum for any individual coupon of 40 kips.

Gas welds—An average of 52 kips, with a minimum for any individual coupon of 50 kips.

The program specimens were welded under a specified procedure. Four welders employed the oxyacetylene (gas) process; one welder the alternating-current arc process; all other welders used the direct-current arc process.

All specimens were subjected to a tension test to determine the ultimate load and, when possible, the yield point, although it was realized that the latter represents the yield point of the specimen as a whole rather than that of the welds.

Of a total of 61 welders who participated, 42 welded

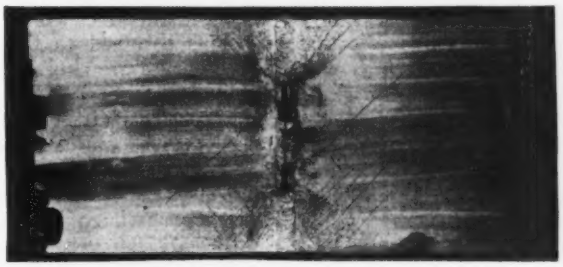


Fig. 4—Failure of intermittent butt weld
Committee explains failure of center weld while Luder lines are more apparent in side welds by the fact that the stress in the center weld, while being greater than in the side welds, is spread over a 17 per cent greater area of the bar so that its Luder lines do not become prominent before failure occurs.

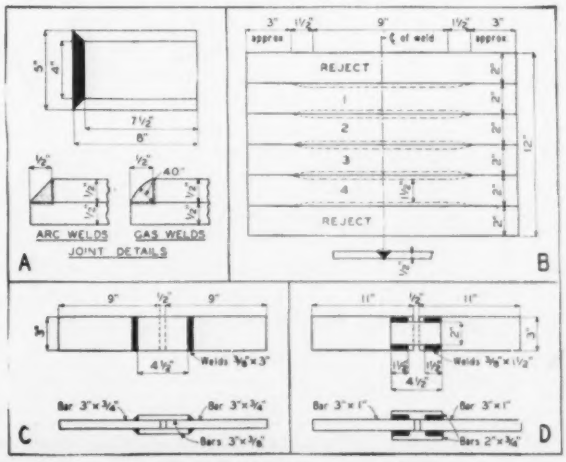


Fig. 5—Qualification test specimens
Specimen *A* was tested by prying plates apart with a wedge until weld ruptured, revealing texture of weld metal and penetration. *B*, *C* and *D* are tension test specimens.

[2]The program was made possible through the generous and wholehearted cooperation of a number of organizations. The required funds were contributed by the American Institute of Steel Construction and individual members of the following organizations: National Electric Manufacturers' Association; Compressed Gas Manufacturers' Association; Gas Association; Gas Products Association; and the International Acetylene Association. The steel was donated by: Bethlehem Steel Co.; Carnegie Steel Co., and Illinois Steel Co. In addition all the fabricating companies welded the specimens free and two commercial laboratories tested many specimens without charge.

[3]A kip is 1,000 lb.

program specimens. Eight of the latter failed to qualify, but for reasons fully set forth in the report it was deemed expedient to include their specimens. Fig. 6 gives the essential data gathered from the qualificaton tests of the 34 welders who passed the tests and subsequently welded program specimens. Each vertical line represents a welder arranged in such sequence that in the upper chart the average strengths of their twenty coupons are in descending order to the right. In the same chart is plotted each welder's minimum individual coupon. The center chart gives the "dispersion percentage" of the coupons. The values were obtained by computing the percentage variation of the strength of each coupon from the average strength of a welder's twenty coupons, regardless of sign, and then averaging the variations, this average being the dispersion percentage.

Evaluating Welder Performance

In determining the relation between the results of a welder's qualification and program tests it is necessary that specimens prepared by one welder be identical with those of any other welder with whom his performance may be compared. Such a direct comparison is possible for the six groups shown in Fig. 7 in which the welders prepared identical specimens. Each welder's qualification strength average has been expressed as a percentage of the average for the group. In a like manner the strength of each welder's program specimen has been expressed as a percentage of the average for the group. Each group is considered separately, the average for any one group bearing no absolute relation to that of any other group. The letters between the two charts are the welders' identification marks as assigned to them by the committee. In general, the curves are similar in shape, although differing in amplitude.

With the exception of these six groups direct comparison is impossible. Another method of evaluating a welder's program performance was adopted. The average strength of each specimen group in a series was determined and the strength of each specimen in that group was computed as a percentage of the average. These percentages for each welder were then averaged; the results are plotted in the lower curve of Fig. 6.

While none of the results was poor, a glance at Fig. 6 shows that as a group the first twelve welders performed well above the average, their performance rating being 105.3 per cent and their qualification average exceeding 55 kips, with only one coupon below 45 kips. The committee ascertained that this group included several welders with long experience in work of a more exacting character than structural work. It therefore seemed desirable to search for a group that would be more representative of commercial practice in structural shops. The welders were finally divided into Classes I and II as shown in Fig. 6. The 26 welders in Class I qualified with an average of more than 52 kips, and with the exception of three coupons no individual coupon fell below 45 kips. The program performance rating of this group averaged 100.7 per cent. The eight welders in Class II qualified with an average less than 52 kips and with higher dispersions, while their performance rating averaged 98.2 per cent.

It is interesting to compare the number of years of experience reported by welders with their test results. The average length of experience of welders in Class I is 8 years; of those in Class II 3¾ years.

The committee considers the results of the group of 26 welders (Class I) to be a fair indication of what may be expected in commercial structural practice. Regardless of geographical location, the qualification tests of welders were reflected by their subsequent program performances, the closeness of the relation varying in general with the qualification ranking. For purposes of group classification, a consideration of both qualification and program results seems to establish the proper qualification average at 52 kips per sq.in. and the minimum at 45 kips.

Test Results and Safety Factors

When the committee approached the study of the program tests to determine safe unit working stresses it was found desirable to take account of contemporary developments. In 1928 the American Welding Society formulated and published a "Code for Fusion Welding and Gas Cutting in Building Construction," in which the following unit stresses per square inch of throat were specified:

Shear	11.3 kips
Tension	13.0 kips
Compression	15.0 kips

These same unit stresses had been used with satisfactory results in the design of several welded structures. It was decided to examine the test results from the standpoint of their factors of safety when based on the unit stresses of the code.

The specifications prepared by the committee permitted a certain overrun in the desig-

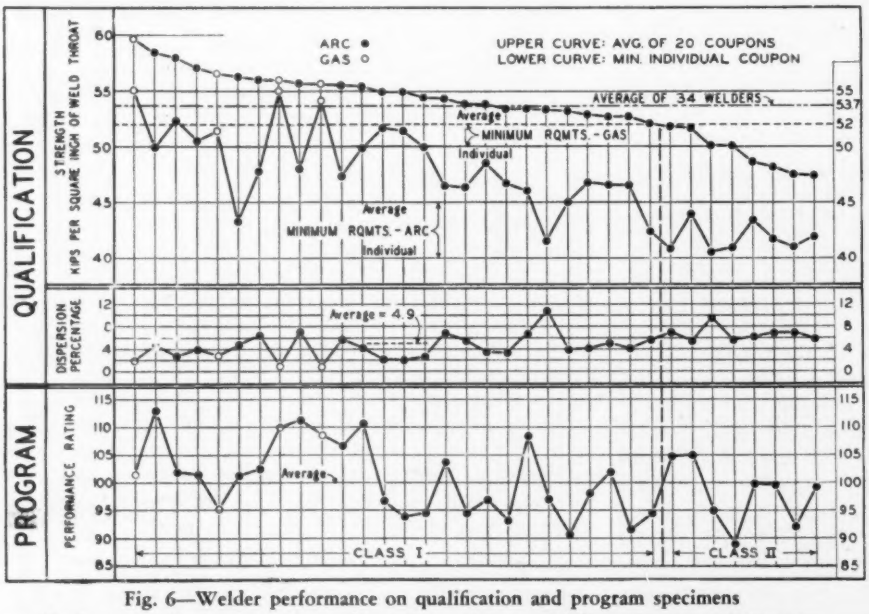


Fig. 6—Welder performance on qualification and program specimens

Each vertical line represents a welder. The points on the dispersion percentage curve are obtained by computing per cent variation of each specimen from average strength of twenty specimens and taking an arithmetical average of the variations regardless of sign. Performance rating curve expresses the relation between the strength of each specimen in a group of specimens and the group average.

nated sizes of welds which made it necessary to adopt a logical method of tabulating the actual test results in terms of the units of design. No deductions were made from the gross lengths of gas welds or of arc-butt welds, but ¼ in. was deducted from the gross length of arc fillet welds. The cross-sections of all fillet welds were reduced to a common basis by expressing their actual throat as a ratio of the designed or minimum size specified.

An examination of the results shows that the fillet welded joints fall naturally into two classes, those with negligible and those with considerable eccentricity. Fig. 1 gives the test results for both classes. In the first class (Fig. 8) occur those forms of joint that are not subject to prying effect and in which there was a negligible amount of bending across the welds. [NOTE: The flexure to which fillet welded joints may be subjected is of two kinds. In the kind that is here termed "prying," the flexure is resisted mainly by the weld width, and in that case the distortion tends to pry open the weld. In the kind that is termed "bending," the flexure is resisted by a longer lever arm, such as the weld length (Series 2100) or the distance between a pair of welds (Series 1300), and in that case the distortion occurs mostly in the bars.] In the second class (Fig. 9) occur the forms of joint that are subject to prying effect. This class includes the forms of joint shown in Fig. 2. In all these forms there was considerable bending, which caused failure to occur in the bars or induced excessive prying on the welds.

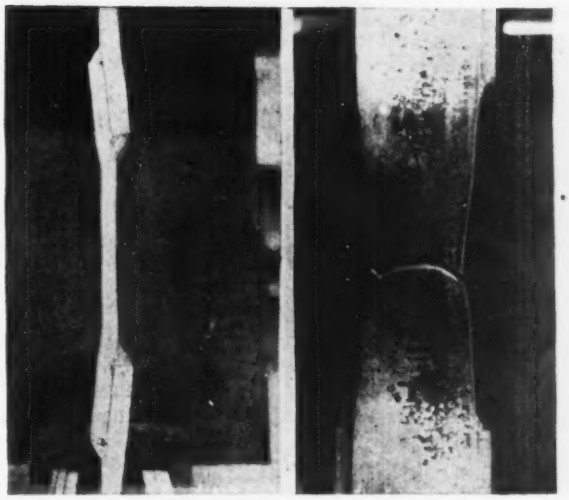


Fig. 8—Typical failure of a specimen (Series 1300) in which flexure produced bending in the bars

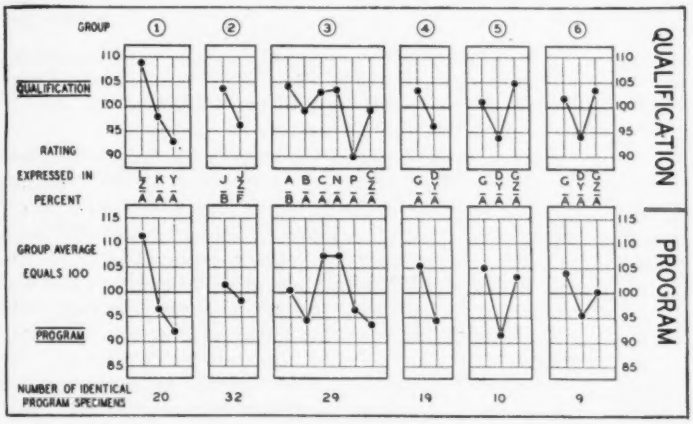


Fig. 7—Relation between a welder's qualification and program test results

Each welder's qualification strength average and program strength average for a specimen is expressed as a per cent of the average for the group of specimens. Capital letters denote the welders.

As previously stated, the committee found it desirable to recognize existing practices as far as possible by referring the test results to a working value of 11.3 kips per sq.in. A factor of safety of 3⅓ is commonly accepted in structural design—that is, steel whose ultimate strength averages 60 kips is subjected to a working stress of 18 kips. Therefore it would have been consistent and proper to divide the average ultimate strengths of the welded specimens by 3⅓ in order to determine corresponding working loads. The same result was effected more conveniently by reversing the process—that is, computing the respective factors of safety for each specimen, using the accepted working stress.

In connection with the joints with negligible eccentricity it will be observed from Fig. 1 that the ultimate unit strength varied within moderate limits for the several series. The averages per square inch of throat area ranged from 34 to 53 kips and the individual minima from 25 to 45 kips. The committee concluded that all specimens of this class should be considered as one group for purposes of valuation. The factors of safety for this class were as follows:

Symmetrical Specimens
- Average varies from 3.28 to 4.70. Weighted average 3.80.
- Minimum varies from 2.21 to 3.18.

Non-Symmetrical Specimens
- Average varies from 3.01 to 4.55. Weighted average 3.74.
- Minimum varies from 2.39 to 3.98.

Weighted average of entire class 3.76.

The strengths of joints with considerable eccentricity do not furnish a basis for design, for it would be improper to exterpolate these values as a guide to the effect of bending in joints having other dimensions. The effect of such bending must be analyzed for each design as is now done in riveted work. Welds located as shown in Series 6200 and 6400 are very common in structural practice (for example, attaching the top flange of a beam to a column), but there is this one important difference: the beam is effective in resisting the bending, with the result that the weld functions as in Series 6300 and 6500 and develops a much higher strength.

For the butt welds in tension the weighted average ultimate strength of 293 specimens is 49.6 kips per sq.in.

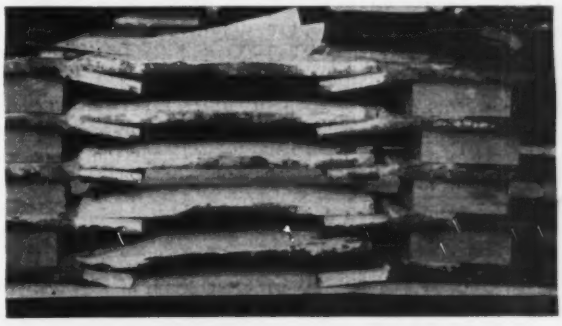


Fig. 9—Typical failure of specimens (Series 1000) in which flexure produced prying on the welds

of throat area. The dispersion of values is somewhat greater than in the case of fillet welds. Based on a working stress in tension of 13.0 kips per sq.in. the average factor of safety is 3.80. Only 3 per cent approximately of all the joints tested had factors of safety of less than 3.00, the minimum being 2.38.

No compression tests were included in the investigation, because such specimens when tested to destruction always fail by sidewise deflection, never by crushing, and the resultant stress is a combination of shear and compression.

Conclusions and Recommendations

The committee's conclusions are limited to the features embraced in the present investigation. It is not in a position to say to what extent its conclusions would apply under other conditions. The more important conclusions are here listed.

Fillet Welds, ¼ to ¾ in.

1. The most important factor affecting the strength of the welded specimens was the bending or prying action induced by various non-symmetrical conditions.
2. Other considerations equal, end welds were 35 per cent stronger than side welds, but side welds exhibited much greater uniformity, minimum values for the two types differing by only 8 per cent.
3. Increasing the thickness of the bars provided additional stiffness to the joints and consequently greater weld strength, but this stiffness was partly offset by increased bending moment on the fillets.
4. The variation in strength of welds of different sizes is not sufficient to warrant the use of different working stresses.

Butt Welds, ¼ to 1 in.

1. In this investigation, square joints did not exceed ¾ in., single vee ¾ in., and double vee 1 in.; and within these limits the weld strength was not appreciably affected by the form of joint.
2. Unit strengths of continuous and intermittent welds were substantially equal.
3. Unit strengths were somewhat greater for the smaller than for the larger welds.

General

1. No harmful effect on the base metal due to the welding was disclosed.
2. No important difference was found in the strength of welds made by any of the fusion welding processes employed.
3. Until such time as further tests on short welds are made the committee is of the opinion that it is preferable to follow a rule commonly used in the design of strength welds whereby the minimum length is four times the size of the fillet leg, or of the butt weld throat.

Fillet-Welded Qualification Specimen Suggested—Although the butt welded form of qualification specimen provides a rigorous test of the welder's ability, the committee recognizes the need for a fillet-welded form. To be readily useful, any specimen should come within the testing capacity of the average laboratory machine, which is 100,000 lb. Specimens shown in Figs. 5C and 5D have been giving satisfactory qualification results in structural shops. They are counterparts of the program specimens of Series 1900 and 2300. The committee is of the opinion that either of these two fillet-welded forms of specimen constitutes a satisfactory tension test for structural welders when required to show a minimum strength of 12 kips per linear inch of weld.

A Recommended Qualification Test—Qualification tests are recommended for all structural steel manual welders employing either the arc or the gas process, as follows:

1. Preliminary test with the wedge specimen of Fig. 5A.
2. One of the following tension tests:

(a) Butt-Weld Test.

Two specimens as shown in Fig. 5B are considered sufficient, one to be welded in a flat position, the other in a vertical position. The four coupons, when cut from each specimen and the welds ground flush, should show a minimum ultimate strength in tension, per square inch of throat, of 45 kips, with an average for the eight coupons of 52 kips.

(b) End or Side Fillet-Weld Test.

Two specimens should be prepared as shown in either Figs. 5C and 5D in each of the positions (flat, vertical, overhead) that will be required in the welder's subsequent work. When tested in tension, each specimen should show a minimum ultimate strength, per linear inch of weld, of 12 kips, equivalent to a total load on the specimen of 72 kips.

Equivalent qualification tests should be made for automatic machine welds.

Final Conclusions—With respect to the two principal objects of the investigation the final conclusions are:

1. The permissible unit stresses, in kips (thousands of pounds) per square inch of weld throat (11.3 for shear, 13 for tension and 15 for compression) specified in the American Welding Society's "Code for Fusion Welding and Gas Cutting in Building Construction" are safe and reasonable, and are indorsed, provided the welder has been qualified and provision has been made for bending stresses that may be introduced due to eccentricity. Maximum fiber stresses due to combined bending and direct stresses should not exceed the values given above for direct stresses.
2. In commercial practice a welded joint may be expected to have a strength within 12 per cent of a general average for that type of joint, provided the welder has attained the stated qualifications.

The designed length of a weld is the length obtained by dividing the total stress on the weld by the working unit stress. It is the length along which full cross-section and fusion are secured. In order that the weld as made may accord with these requirements, in the case of arc welded fillets ½ in. should be added, and the crater should be filled. No addition need be made for gas-welded fillets, nor for butt welds made by either process.

The cross-section of welds should be measured by gages similar to those used in this investigation. The minimum limits should correspond with the designed size of the welds.

Fields for Further Research

With a view to extending the scope of its conclusions, the committee suggests the following fields as desirable for further research:

1. Welds of greater cross-section.
2. Welds of shorter length.
3. Butt welds in shear.
4. Diagonal butt welds.
5. Slot welds.
6. Welding on flame-cut edges.
7. Welding on other grades of steel.
8. Tests on full-sized structural joints.
9. Impact and variable stresses.
10. Welding on members under stress.

Status of Building-Code Revision

A recent report of the division of building and housing, U. S. Bureau of Standards, lists the results from a questionnaire sent out to cities relative to the status of building-code revision work. The following tabulation shows the situation in municipalities of 5,000 or more population.

Age of Code, Years	Number of Cities
20 and more	88
15-20	126
10-15	162
5-10	342
Under 5	419

Second of a Series of Articles on Distribution of Construction Materials

Brick: A Critical Analysis of Practices and Trends

By O. FRED ROST
Marketing Editor, The Business Week, New York

IN THE FIRST ARTICLE of the series, published Sept. 10, 1931, the author defined the nature and importance of distribution problems and indicated the wastes or economies at issue. He now takes up the specific matter of how brick moves from the yard to the job.—EDITOR.

Let us make brick, and burn them thoroughly.—Genesis, xi, 3.

ANY STUDY of distribution must embrace specifically such major functions and such important factors as may be directly or indirectly involved in the process by which under prevailing practice the distribution of a given commodity is accomplished. In the case of brick, therefore, we are interested in just what takes place between the point of finished production—namely, the kiln at the brickyard—and the place of final use, where bricks pass into the hands of a builder or the bricklayer to become component units in a construction job.

Everybody knows that brick as such constitutes the oldest man-made construction material; that brickmaking is one of the world's oldest industries. If the distribution practices of this thousand-year-old industry are here and there encumbered with outworn practices, it is hardly to be wondered at. Sentimentally these practices may be justified, on the ground that "we always have done it that way"; yet in the light of present-day knowledge of fundamentals of marketing and distribution they may be serious weaknesses of the industry.

Old Customs Favor Conservatism

There is perhaps one definite reason for this state of affairs—namely, this: The manufacturing processes employed in the brick industry, from claypit right through to the kiln, are fundamentally identical with those employed by the Egyptians 3,500 years ago. Further, perhaps 99 per cent of the industry's products are in general shape to quite a degree identical with the bricks referred to in the first book of the Bible. Of course, the nature of the raw material required, its source, its weight, the inherent need of having the manufacturing processes performed in close proximity to the source of the raw materials, even the very nature of those processes, all are factors that have definitely limited the opportunities for freer development of the art of brickmaking. To a certain extent the same factors have limited the field for development of new styles, shapes or other improvements in the product, or at least have retarded creative effort in that direction.

Therefore in discussing distribution practices in the brick industry we must remember that we are dealing with an industry that has not had the stimulus of revolutionary changes in production methods. It has not experienced the revivifying influence of new styles, new models. Only in comparatively recent years has it made organized effort to offset the inroads of new construction materials and of new and improved methods of using old competitive materials. It has only in comparatively recent years addressed itself seriously to the task of building a wider market for its product by the development of new styles, shapes, colors, new methods of use and application.

All this being so, it is not to be wondered at that processes and practices involved in the distribution of brick reflect to a considerable extent the same state of affairs that has existed in the production branch of the industry. There is a distinct tendency to adhere to the old ways of doing things, on the theory that what was good enough in grandfather's time is good enough now. In fact, few other industries have as many father-and-son, or even grandfather-father-son combinations of managing heads in active control of businesses. One case is reported where the present owners of an important brick company are straight-line descendants of Dutch brickmakers who came to this country over 400 years ago. These limitations, imposed by the nature of the product, the processes involved, the age of the industry and its outworn traditions, are cited as extenuating circumstances in an otherwise readily supported charge that the brick industry as a whole has not been particularly progressive and has failed to keep step with the times.

Hand Labor and Costly Transportation

The fact cannot be disputed that observing the processes by which physical distribution of brick is accomplished in 1931 means in most instances witnessing antiquated methods. Brick are still in most cases removed from the kiln by hand. They are stacked in the yard by hand. They are loaded on freight car, truck or barge by hand. They are unloaded by hand. And, after being thus manhandled many times, they are finally carried to the point of actual use by hand and laid into wall, walk or sewer also by hand.

Adding to the necessarily high labor costs is the fact that transportation costs of brick are extremely high compared with the actual value of the product. For this reason brick distribution is generally completed within a comparatively short radius from the point of production. Because of short radius distribution, however, most brick manufacturers are in the unique and enviable position of producing in close proximity to their market—an invaluable strategic advantage, which few of them have been willing to capitalize properly, however, until recently. Most brick producers have been content to sell their output to dealers, brokers or commission agents, and have made little or no effort to establish direct con-

tact with those who in the final analysis determine their fate—namely, the architects, builders and home seekers.

For reasons that are not hard to find this condition is now changing, slowly but surely. During the post-war building boom the production capacity of the brick industry was increased far beyond its normal requirements. In 1927, the peak year, more than 7 billion common brick were produced, valued at more than 78 million dollars, while the 2.4 billion face brick made that year were valued at more than 41 million dollars. Since then the demand has fallen steadily. In 1929 common brick production had dropped 20.2 per cent, the output of face brick 12.2 per cent. Last year, 1930, saw a further substantial reduction. With building operations in some territories practically at a standstill and few or no orders obtainable through the customary trade channels, some manufacturers experienced difficulty in disposing of brick enough even to pay operating expenses; to avert disaster they sought other outlets. Some enlisted the direct cooperation of building supply dealers. Some went to architects, some direct to building contractors, prospective home builders and operators on large projects.

The effect of this new trend will probably not become apparent until building is resumed on a broader scale. Nevertheless it cannot be disputed that because of economic conditions prevailing during the last three years the brick industry has been in a state of extreme flux. Furthermore, it may be reasonably expected that as and if present trends develop into accepted practices the industry will find itself much better off because of the experience.

Survey Shows Large Overcapacity

The results of a nationwide survey, but recently completed, provide interesting data and information on present distribution practices in the brick industry and at the same time indicate quite clearly the nature of the major trends that are evidently being developed. While this survey was conducted separately in each of the three major branches of the brick industry—namely, those making common, face and paving brick respectively—the similarity in product was reflected in the similarity of distribution practices and trends. Therefore the results will be analyzed collectively, except that mention will be made of outstanding differences and characteristics peculiar to one particular branch.

The survey covered brick manufacturers located in various parts of the country—near the Atlantic seaboard, on the Pacific Coast, in the states along the Canadian border, in southeastern and far southern states. The largest maker included in the study has an annual capacity of 700 million brick, while the smallest can make but 7 million per year.

The report on production capacity of various plants indicates that the industry itself is responsible for many of its present difficulties that have arisen as a direct result of overcapacity. Within the ten years 1920 to 1930 increases of 50 per cent are reported by a number of plants. Several plants pushed capacity up 100 per cent, but only one of those reporting, a New England concern, actually reduced capacity (by about 20 per cent).

These increases in capacity, probably all made prior to 1927, are of course directly responsible for the fact that since 1927 so many makers have been operating at steadily reducing fractions of actual capacity. In the common brick group, plants covered by the survey operated at 51 per cent capacity in 1929, and at 33½ per cent in 1930, while a considerable number were shut down entirely and for an indefinite period. Face brick output in 1929 averaged 68 per cent of capacity, but in 1930 dropped to 48 per cent; it is expected to remain low until building operations take a decided upswing. Only in the paving brick group was output approaching capacity; plants reporting averaged 85 per cent during 1929 and 1930.

These figures on capacity versus output are quoted because the condition they reflect constitutes the underlying reason for some of the changes in distribution practices that are obviously in progress.

Transportation Costs Cut by Trucks

Cost of transportation has always been an important factor in the on-the-job cost of brick, and in many areas has constituted a direct handicap to the freer use of brick in construction operations. Freight rates are high, and in addition shipment involves also the expense of frequent and costly handling. At the yard handling costs can be reduced by direct loading into freight cars, when orders are on hand; but at the delivery end there is handling from freight car to truck, truck to storage, storage to job.

However, this excessive part of distribution costs has in recent years been rapidly and decisively cut, through the steadily growing use of motor trucks and equipment for mechanical handling. Delivery of bricks by motor trucks, even when these are not equipped with mechanical handling devices, has valuable advantages in that it requires fewer handlings and is quicker and more direct—in most cases direct from yard to job. This fact has been capitalized particularly by makers of common brick. Yards that in 1913 shipped up to 90 per cent of their output by rail shipped less than 50 per cent that way in 1929.

Specific cases were found where yards that sold many million brick in 1930 had shipped but three or four carloads by rail, the remainder having been moved by truck direct from yard to job. In such yards, where the bulk of the product is shipped by truck, mechanical handling devices are used to an increasing degree to cut the cost of handling and make possible more profitable operation.

Since freight rates are not likely to be lowered and since the use of container cars for delivery with one handling from yard to job is feasible only in certain territories, it is probable that the practice of delivering brick by motor truck will continually increase.

Also the radius within which motor truck delivery is found profitable has been steadily extended with the aid of roads, the use of pneumatic truck tires and mechanical handling devices. Yards which in 1913 made practically no deliveries by motor truck and which in 1920 delivered only within an average radius of 12 miles had extended that average to 23 miles in 1929. In some territories truck deliveries of brick are made regularly by motor truck to markets 60-odd miles distant from the yard.

Direct Selling

I have already mentioned that makers of brick have erred in failing to establish more direct contacts with the ultimate sellers and users of their product. It is therefore interesting to note just how that condition appears to be changing in certain directions as indicated by the survey.

The percentage of total sales of common brick from maker direct to user averaged for the group the same in 1920 as it did in 1930—30 per cent—while in the face brick industry it dropped from 33 per cent in 1920 to 20 per cent in 1930. Sales of common brick to building supply dealers and wholesalers who carry a stock averaged 31 per cent of the total in 1920, but rose to 35 per cent in 1930, while on face brick it rose from 30 per cent in 1920 to 39 per cent in 1930. But in some territories, particularly those that include large cities, as high as 75 per cent of the output of some plants went to dealers in 1930.

Commission agents and brokers are an important factor in the distribution of brick in some localities. These will contract for or buy outright quantities of brick from the manufacturers and then dispose of them to dealers or builders at such profit as they find the traffic will bear but without actually handling the material. They generally order the goods shipped only after they have secured a buyer. Prior to and during the building boom that reached its peak in 1927 these brokers and agents did a particularly flourishing business, some of them taking practically the entire output of certain yards. Now that business has become scarce, yards that previously sold chiefly through brokers have found it necessary to seek other markets for their product. They helped to bring about the state of dog-eat-dog competition that has existed in some sections for the last year or two.

Marketing and Distribution Improving

Apparently this very state of unwholesome, destructive, uneconomic competition is forcing the industry, or at least many of its units, into the adoption of better methods in two important lines of activity. The processes by which the functions of physical distribution of the product must be performed are being modernized while methods of marketing are being improved. It is interesting to note that the survey clearly shows how the speed with which marketing methods are being improved has been materially accelerated by the promotional activities that have been sponsored by the trade associations that are serving the several branches of the industry.

Of all brick manufacturers covered by the survey only one reported that he had received no direct benefits from the marketing activities, advertising and field work carried on by trade associations to build bigger markets for its product. This manufacturer is located in a section that was intensively developed during the World War and has suffered an economic depression ever since. Others were very outspoken in praising the value of the assistance extended by their respective associations, and some specifically stated that the work should be further extended.

Changes in the Product

As stated previously, progress in the brick industry has been retarded by lack of the stimulating influence of style changes. It is of course unlikely that for the bulk of the output the standard shape of brick will ever undergo any radical change. However, some progressive manufacturers are definitely at work to bring out new shapes and styles, to improve the art of brickmaking, so as to widen their market. They propose to give engineers, architects and designers a greater variety of shapes and styles to incorporate in their designs. One large brick company has developed one line of 27 shapes of brick to meet a large variety of different uses. A new shape and style of brick for facing is on the market, which when laid gives an entirely new effect, quite unlike brick. A line of shapes is obtainable that will give beautiful columnar effects. Promoting the use of reinforced-brick masonry is also expected to widen the market.

Thus it appears that the brick industry under the urge of dire necessity is doing many things that on the surface may seem revolutionary but that actually constitute what manufacturers in other lines must do frequently and continuously in the interest of self-preservation.

[*The third article of the series, "Can the Brickmaker Improve His Distribution?" will appear Oct. 1.*—EDITOR.]

Tests of Concrete Columns With Solid Metal Cores

RECENT EXPERIMENTS on the strength of reinforced-concrete columns having solid cylindrical cores of cast iron and steel are of interest in view of the use of such columns with cast-iron cores in several tall buildings, as noted in *Engineering News-Record* of July 25, 1929, p. 129, and Feb. 13, 1930, p. 277. In these tests there were twelve columns of the cored type and two without cores. All were 5 or 7 ft. long, of octagonal section 7½ in. across the flat faces, reinforced by four ½-in. deformed vertical bars and 0.1055-in. wire wound in a 6½-in. spiral of ½-in. pitch. The metal cores were 4 and 5 in. in diameter, representing 37.9 and 59.1 per cent of total area. But in all the columns with cores the spiral was disarranged considerably during pouring, and the space between the spiral and core was not well filled with concrete. Average results are given in the accompanying table, condensed from a paper by L. J. Mensch in the *Journal* of the American Concrete Institute, November, 1930.

TESTS OF CORED CONCRETE COLUMNS

Core Type	Diameter, in.	Ultimate Load, Lb.	Load Per Sq. In. of Column Lb.	First Spalling Lb.	Ave. Load Per Sq. In. of Column, Lb
None	...	Min. 193,000	5,810	.....	6,745
None	...	Max. 255,000	7,680	.....	
Cast iron	4	Min. 525,000	.....	440,000	17,400
Cast iron	4	Max. 616,000	.....	470,000	
Cast iron spliced*	4	Min. 609,000	.....	470,000	19,150
Cast iron spliced*	4	Max. 626,000	.....	370,000	
Cast iron	5	Min. 980,000	.....	800,000	29,800
Cast iron	5	Max. 997,000	.....	740,000	
Steel	4	Min. 557,000	.....	530,000	17,300
Steel	4	Max. 561,000	.....	525,000	

*These cores were in two pieces, spliced by sleeves of thin wrought-iron pipe.

Specimens of broken concrete gave an average compressive strength of 5,600 lb., but 6-in. test pieces 12 in. long cut from the concrete showed 5,740 to 5,940 lb. Specimens from the vertical rods showed a yield point of 49,200 to 53,500 lb. per sq.in. and an ultimate strength of 77,500 to 83,700 lb., while the elongation in 8 in. ranged from 18.1 to 29.9 per cent. Specimens of the wire spiral gave 100,000 to 103,000 lb. per sq.in. ultimate strength, with 45.5 to 52.2 per cent reduction of area at fracture. Test pieces from the cores gave ultimate strengths of 95,300 to 103,000 lb. per sq.in. for cast iron and 36,800 to 37,800 lb. for steel. These tests, made for L. J. Mensch, civil engineer and contractor, Chicago, were conducted at the engineering experiment station, University of Illinois, under the direction of William J. Putnam, assistant professor of theoretical and applied mechanics.

Field Observations of Highway Practices

Asphalt-Hardened Shoulders in Connecticut

By C. S. Hill
Associate Editor
Engineering News-Record

Asphalt-penetrated tar-sealed shoulders of roadside soil increase travel width, reduce edge breaks and cut maintenance costs

STATE HIGHWAY PRACTICE in Connecticut has virtually standardized on bituminous shoulders. This construction is used both for rigid pavements and on old roads of macadam types. On rigid pavements the true shoulder function is clear, but on the flexible types shoulder construction merges into a surface-widening process as continued working bonds the shoulder material with the edges of the true pavement until the dividing line is seldom distinguishable. There is, however, always the difference that the shoulder zone is a treated roadside soil—a shoulder construction and not a road surfacing in the sense of a penetrated or mixed selected material.

Construction—Construction methods and materials are alike for all types of roads. The shoulder material is graded to a uniform cross-slope conforming to the transverse profile of the pavement. A 45 per cent asphaltic road oil is then applied by a pressure distributor in an amount up to ½ gal. per square yard, as the material will absorb. A road hone is then used to mix thoroughly the oil and the shoulder material. If this material is particularly sandy, the first application of oil may be followed by a second and even a third of ¼ gal. a square yard until a uniform mixture is obtained to a depth of 2½ to 3 in. This mixture is allowed to set, honing being continued as the material compacts and hardens under traffic until a reasonably uniform cross-slope and grade prevail. Finally ⅛ to ¼ gal. of cold surface tar is applied, covered with sand and honed.

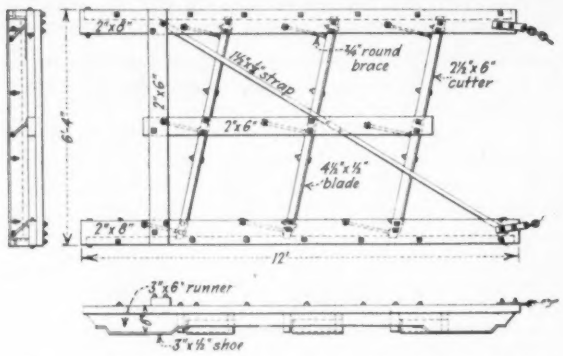


Fig. 1—Standard hone for mixing and light surfacing

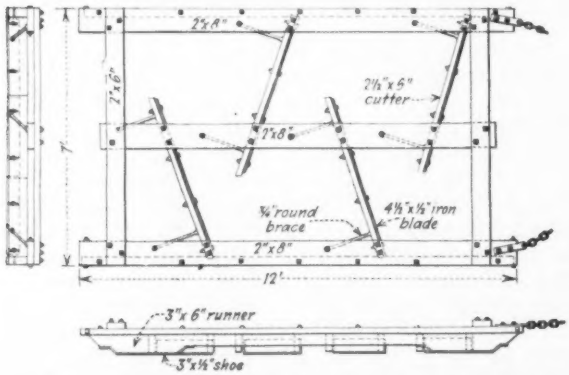


Fig. 2—Zigzag hone for heavy cutting and shaping
A heavy all-steel hone of this type, 17 ft. long and 6 ft. wide, is also used. This has four zigzag blades and a rear blade of full width set diagonally.

Fig. 3—Typical honing operation on macadam road
Wood hone used after surface application of tar and sand to even the surface and distribute material over full width of old road and new shoulder.

The quality of mat obtained varies with the shoulder material. In Connecticut the prevailing roadside materials are gravel, sand and sandy loam. These have all been successfully consolidated. It is believed from experience with certain clay mixtures that a clay shoulder to which sand has been added can be treated successfully. The honing process is an important factor in hardening and shaping the shoulder. It must be repeated until final shaping is secured and then often enough to keep the shoulder smooth, sometimes a light smoothing and again a deeper cut and larger shifting of material. Skill, care and conscientiousness in honing are essential to success. Figs. 1 to 3 show the hones and honing process. The cost of the completed shoulders is 10c. to 15c. a square yard.

Results—Primarily, the purpose of bituminous shoulders was to increase the travel width of old roads, mostly macadam types, that had been built 14 and 16 ft. wide. These could not at once be reconstructed to

Fig. 4—Widened macadam road

To the left of the stone is bituminous shoulder construction widening the road from 14 to 22 ft.

Fig. 5—Concrete road with bituminous shoulder construction in progress

The shoulder has been graded and the first treatment of ½ gal. 45 per cent asphalt oil applied.

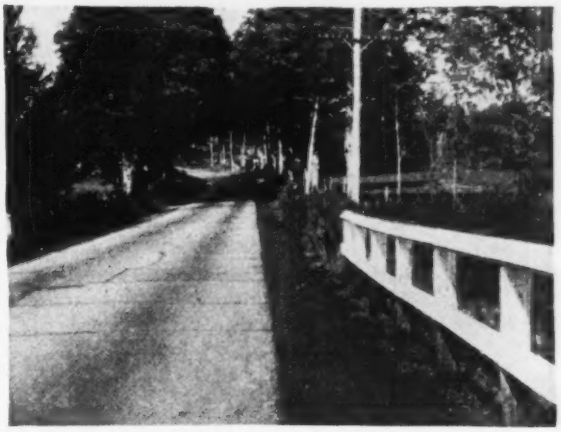


Fig. 6—Concrete road with completed shoulders

Treatment has consisted of two applications of 45 per cent asphalt oil with a surface application of tar.

modern standards, and frequently travel did not warrant such expense, but it did require additional width. The treated earth shoulder was an inexpensive way of securing width. In the case of these old roads the improvement classifies as widening rather than shoulder construction; the new work has practically doubled their original width. Also on these roads, after the shoulder widening is once consolidated, maintenance (oiling and honing) is a full-width operation, so that gradually the crown is pulled down, the haunches built up and the old and new work welded together until they are alike in surface (Fig. 4) and are used indiscriminately by travel.

The bituminous construction becomes true shoulder construction on higher-type roads, as shown by Figs. 5 and 6. There is no change in materials or methods of construction, and oiling and honing are the same—if anything, more exacting—so that on a consolidated shoulder the travel of a vehicle over pavement edges, off and onto shoulders, causes a hardly perceptible shock. Not only is the shoulder distinctly improved in strength and surfaces but maintenance costs are reduced. Despite the higher quality of work required, the actual shoulder-maintenance cost is less than that of untreated shoulders. Careful records covering six years of old and new practice show no increase in cost with traffic doubled in that period. There has been also a pronounced reduction in the cost of keeping up the paved or surfaced zone; the new shoulders have reduced breakdown of pavement edges and kept water from getting under them.

When bituminous shoulder construction was first undertaken it was presumed that it would be of value only during dry periods and that the shoulder would break up under frost and water action in winter and spring. Actually, however, a noticeable result has been the stability of the shoulders in spring and under bad-weather conditions. While the shoulders at a few locations may break under abnormal conditions, in general they remain intact and in surface. This is particularly true where treatment has been given in the previous late fall and the bituminous material remains alive through the winter. In general this material, lying dormant through the winter, becomes active in spring and is a real agency in preventing the usual breakup.

Summary—Experience with bituminous shoulder construction in Connecticut demonstrates that a wider travelway has been furnished; that constant maintenance of earth shoulders damaged by storm washing has been largely eliminated; that ordinary soils, except clay, can be bituminized; that soft shoulders and rutting are done away with; that shoulder and pavement edge upkeep have been reduced; that only simple materials and processes conscientiously used are required; and that traffic is increasingly served.

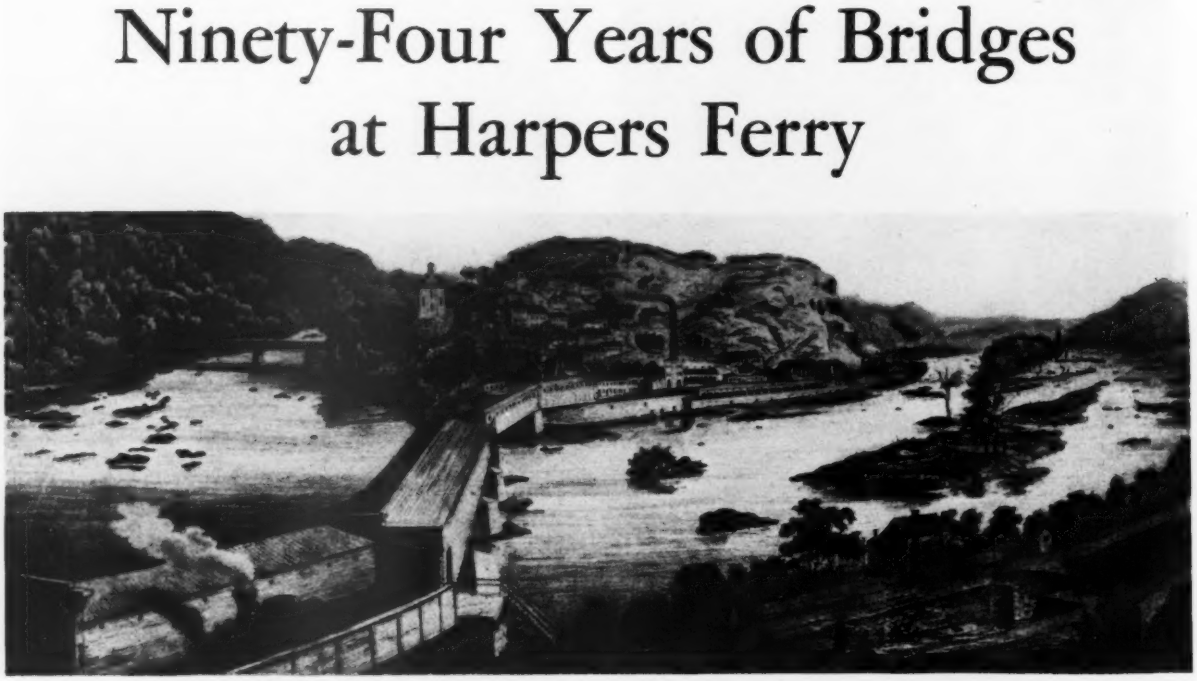
The work described is being done by the Connecticut state highway department, John A. Macdonald commissioner, E. C. Welden deputy commissioner, and G. E. Hamlin superintendent of repairs.

Public Water Supplies in Ohio Villages

The number of Ohio villages of 2,500 or less (excluding suburban) having and not having public water supplies is as follows, according to *Ohio Health News* (state department of health, Columbus, Ohio) for Aug. 1, 1931:

Population	With Public Water Supply	Without Public Water Supply
2,500 to 2,000	21	2
2,000 to 1,500	32	8
1,500 to 1,000	51	28
1,000 to 500	60	118
Under 500	12	309

Ninety-Four Years of Bridges at Harpers Ferry



Timber bridge designed by Louis Wernwag that carried B. & O. Railroad over the Potomac River and Chesapeake and Ohio Canal (right foreground) at Harpers Ferry from 1836 to 1851

From covered timber "arches" of 1836 to Bollman iron trusses and on to modern steel structures, the Potomac River crossing of the Baltimore and Ohio Railroad has made bridge history as well as reflected changes in railroad rolling stock and operating practices

By P. G. LANG, JR.
Engineer of Bridges, Baltimore & Ohio Railroad Co., Baltimore, Md.

A SPECIAL CLAIM to historic distinction attaches to Harpers Ferry, W. Va., as the scene of important developments in the science of railroad bridge design and construction. Each of the structures built by the Baltimore and Ohio Railroad Co. to carry its tracks across the Potomac River at this point has reflected the practice current at the time of its construction, and it is a matter of singular interest that three of these bridges, built at widely different periods, still exist to illustrate the evolution of practice over a period of more than three-quarters of a century.

On December 1, 1834, the tracks of this railroad, the first of the trunk lines, in their westward progress from Baltimore, reached a point on the north shore of the Potomac River opposite Harpers Ferry. At this point further extension of the new line along the north shore of the river was barred by the precipitous ridge of Catoctin Mountain; to the southward the Chesapeake and Ohio Canal and the Potomac River presented a combination of obstacles for the surmounting of which the experience of that day afforded no guiding precedent. Finally, after a period of approximately two years, consumed in engineering investigation and construction, the tracks of the railroad company passed across the river and into Harpers Ferry upon a bridge consisting of a series of wooden arches designed by Lewis Wernwag.

Wernwag's Timber Bridge—The Harpers Ferry crossing, as it appeared between 1836 and 1851, is illustrated in the accompanying lithograph of a contemporary sketch, which shows the original wooden "arches" covered with timber sheathing, in accordance with the practice of that day. By the term "arch" our ancestors designated any form of bridge superstructure other than a timber trestle, and it is probable that this early Harpers Ferry bridge actually consisted of wooden trusses.

The Bollman Metallic Truss—That the possibility of securing a structure better adapted to railroad needs was early recognized is evidenced by the fact that within a few years after the completion of this wooden bridge the railroad management gave serious consideration to reconstruction in different form. Between 1845 and 1850 the iron-truss bridge had been introduced and had won recognition as a type suited to the requirements of railroads. During the autumn of 1851 the reconstruction of the Harpers Ferry bridge in iron was commenced. For this purpose the type of metallic truss developed by Wendel Bollman, for several years master of road of the B. & O. Railroad and afterward a bridge builder of international reputation, was adopted. During the succeeding year the reconstruction in this form of the first span, that at the western end of the structure,

was completed; and on June 1, 1852, the action of the new iron-truss span under three of the heaviest locomotives of that day was observed, with results that are summarized in the following brief quotation from a contemporary work.

> Three first-class tonnage engines with three tenders were first carefully weighed and then run upon the bridge at the same time, nearly covering its whole length and weighing in the aggregate 273,550 lb., or 136.775 (2,000-lb.) tons net, being over a ton for each foot in length of the bridge. This burden was tried at about eight miles per hour, and the deflections, according to gages properly set and reliable in their action, were at center post $1\frac{3}{8}$ in. and at the first post from abutment $\frac{9}{16}$ in.

A traveler who viewed this bridge during June, 1857, describes it in the following words:

> The bridge is constructed somewhat in the shape of the letter Y, dividing as we approach its western end, the left-hand branch connecting with the Winchester and Potomac Railroad, passing up the Shenandoah, and the right-hand carrying the main road, by a bold curve, up the Potomac. The bridge is about 900 ft. in length and consists of six arches of 130- and one arch of 75-ft. span over the river, and an arch of 100-ft. span over the canal. These arches are all of timber and iron, covered in, except the western arch connecting with the Winchester Road, which is constructed entirely of iron, on Bollman's plan.

During the Civil War—The location of Harpers Ferry on the border between the groups of warring states naturally marked it as a spot in which the events characterizing the approach and progress of the Civil War had strong repercussions. It was on the B. & O. Railroad bridge that John Brown and his associates, during the autumn of 1859, crossed the river on their eventful mission.

On April 18, 1861, the detachment of United States troops that garrisoned the arsenal at Harpers Ferry evacuated that point, and during the evening of the same date Virginia state troops occupied Harpers Ferry and placed a guard of infantry and artillery on the bridge.

On June 14, 1861, seven wooden spans and the woodwork in the iron span of this bridge were burned by Confederate troops. Shortly thereafter Harpers Ferry was occupied by the Federals, and the construction of a trestle across the river was commenced by the railroad company. However, due to the exigencies of the war, railroad traffic was not restored over this structure until March 18, 1862.

The strategic importance of this bridge and the difficulty of maintaining trestles in the river caused favorable consideration to be given to the installation of four iron spans in the structure crossing the channel. This work was begun during the summer of 1862, prosecuted under the extraordinary conditions imposed by natural agencies and the emergencies of war, and carried out with such success that, on April 13, 1863, the railroad company could announce "four spans of this magnificent structure completed."

This new bridge was, however, destined to be numbered among the numerous monuments of man's ingenuity, which, during that momentous year, were sacrificed to the developments of the war. During April and May, 1863, a destructive and daring cavalry raid under the Confederate leaders Jones and Imboden crossed the B. & O. line at Altamont and extended its range northward to Mannington. Early in June the masses of Confederate infantry that had, during the preceding weeks, been in process of concentration in the Shenandoah Valley began to move northward by several routes, all of which intersected the line of the B. & O. Railroad, and several of which converged upon Harpers Ferry.

That point was evacuated by Federal troops June 13, 1863. On June 17 the Confederate advance crossed the Potomac River near Point of Rocks. The Federal forces that moved from Harpers Ferry remained on Maryland Heights, north of the river, until June 30, 1863, on which date Harpers Ferry was occupied by the advancing Confederates.

It is interesting to note that, apparently recognizing the value of this bridge as a link in their line of communication, the Confederates preserved the Potomac River bridge intact during the development of the Gettysburg campaign. However, on July 5, 1863, the four new iron spans were demolished by members of Cole's (Federal) cavalry, probably with the intention of impeding the Confederate retreat.

By August 1, 1863, Federal forces had regained complete control of the B. & O.

Harpers Ferry in 1863

Improvised trestle bridge built after new iron spans, in service only three months, were destroyed by Federal cavalry. At right are ruins of arsenal. Note also pontoon bridge.

With the completion of the new deck plate-girder bridge this year three generations of railroad bridges are represented at Harpers Ferry

system, and on Aug 11 through-train service was restored. Incident to such restoration of traffic and the military needs of the time an improvised trestle bridge was constructed at the Harpers Ferry crossing. The date of the picture on the preceding page is uncertain, but it appears probable that it was taken during 1863. It shows measures adopted for the maintenance of traffic at this crossing by means of trestle work and the partial reconstruction of the iron spans, using for this purpose such portions of the metal as it was possible to salvage from the river.

Iron Bridge of 1870—No further efforts were made toward the permanent replacement of the iron spans during the rest of the war. In 1866, preparatory to the installation of new metal superstructure, extensive improvements were made in the stone masonry substructure. Between 1868 and 1870 the work of rebuilding the superstructure progressed steadily, and during the latter year the reconstruction of this bridge in iron was completed.

While for the next twenty years this bridge continued to serve the needs of railroad traffic, the steady growth in weight and dimensions of motive power and rolling stock and the demands for increased speed and economy of operation motivated agitation for an improvement in alignment and the construction of a bridge better adapted to current requirements. The powerful explosives that had become available for purposes of construction rendered practicable the piercing of Catoctin Mountain with a tunnel, thereby greatly reducing the curvature originally adopted on the north side of the river to circumvent this obstacle and also to improve considerably the reverse curvature that this arrangement had introduced at the southern extremity of the bridge.

Bridge of 1894 and Tunnel Approach—In August, 1892, this improvement, involving the construction of the tunnel and a new bridge on the improved alignment, was authorized, and the work was immediately undertaken. On April 12, 1894, the new line was opened to operation, and, under an arrangement concluded with the public authorities, the old bridge was assigned to use as a toll highway structure, in which capacity it is still rendering good service.

During the period subsequent to 1894, as in the preceding years, progressive change was unceasing. Engines and cars continued to become larger and heavier, transportation schedules shorter, and the desirability of further improvement at this crossing was apparent. To this end numerous studies were made, and a definite project was finally adopted that provided for the construction of a new bridge crossing the river on a tangent of the line through the tunnel (made possible by providing the tunnel with a large bell mouth), thus eliminating all curvature at the east bank of the stream and greatly reducing that at the western end of the bridge. The picture on this page, taken Aug. 13, 1931, shows this new bridge of deck plate-girder construction ready to receive modern railway traffic.

Molds Successfully Deodorize Undigested Sewage Sludge

By C. G. WIGLEY
Consulting Engineer, Atlantic City, N. J.

A PROCESS for the deodorizing of fresh sewage solids is being developed at the treatment plant of the Atlantic City Sewerage Co. The process consists of encouraging the growth of molds in the partly dried material. No inoculation is necessary, as the mold spores are in the air in sufficient numbers to seed the sludge. The final product has a high value as a fertilizer base.

Atlantic City sewage is completely domestic in character with the exception of small quantities of cleaning and dyeing liquids. The treatment now given consists of grit removal and sedimentation, with no provision for sludge digestion. The solids deposited in the settling chamber are removed daily in order to maintain maximum settling capacity. The fresh sludge is pumped to shallow sand beds, where it is drained to contain about 95 per cent moisture. After draining, it is removed to an adjacent sandy area and allowed to dry further. Despite its undigested condition, there is no nuisance developed by the stored material.

The writer some time ago observed the deodorizing effect on sewage solids of the growth of mold or mildew. With the thought of applying this process to fresh sewage sludge in order to produce a high-value fertilizer base, a plant using this principle was constructed.

As now practiced, one-sixth of the total amount of sludge from the plant is removed to a drying bed, air-dried to 20 per cent moisture content and then broken up. After grinding, it is stored in a dark building in shallow piles or windrows. Under proper temperature and other environmental conditions the mold soon penetrates the mass. The breaking up of large pieces is necessary so that the mycelium of the mold can penetrate easily. Mold spores are abundant in the air of the building after it has once been used for this purpose, so that seeding is unnecessary. During the process the material may generate considerable heat but no disagreeable odor.

The cured sludge is usually of a musty odor. It is now being sold as fertilizer in Atlantic City for $20 a ton. An analysis of the fertilizing constituents shows:

	Per Cent
Total nitrogen	1.96
Available nitrogen	0.76
Phosphoric acid	0.62
Potash	0.13
Organic material	35.9

The writer believes that if carefully planned and administered, the process would earn a profit for itself and at the same time finally dispose of the sewage solids. To prevent the improper exploitation or misuse of this method, letters patent have been taken out by the writer.

Track Elevation for Joint Line and Union Station

At Dayton, Ohio, an old canal forms site for relocated line used by four railways—Elevated tracks pass union station and have inclines to yards and industries—Structural features described

By GEORGE R. BARTE
Assistant City Engineer, Dayton, Ohio

WHEN traffic conditions and public sentiment at Dayton, Ohio, necessitated consideration of the problem of grade separation, this was found to be simplified by the fact that the four trunk lines serving the city pass through it on the tracks of the Dayton Union Railroad, a 1½-mile line that is jointly owned, includes the union station and has numerous industry connections. This line, built originally at street level and on a rather indirect location, had eleven grade crossings, only five of which were protected by gates, so that as street and railway traffic increased the conditions became serious. According to a report made to the City Plan Board in 1925 by the Technical Advisory Corp., New York, there was an annual average of three persons killed and eighteen injured at the 29 grade crossings in the city, while the loss resulting from interruption of street traffic was about $1,300 daily. The present population is about 200,000.

As the joint line extends directly across the city, several alternative routes for relocations were considered, some of which were on the belt-line principle. All of these latter were abandoned because such a line would traverse present or potential residence districts, would decrease land values in these districts and would not solve the problem of operating the tracks left at street grade to serve industries within the belt. Furthermore, while the city had power, under the Ohio law, to require the railways to separate the grades, it had no power to enforce the relocation as a means of grade separation. On the other hand, the existing line was adequate to handle both passenger and freight traffic.

Of the two direct locations across the city, one followed the original line (with some improvement in alignment) and had eleven crossings. This was the adopted route. The other was about ½ mile south and had thirteen crossings. The adopted line gives the railroads the advantages of a uniform profile and a straight alignment, while its construction would not cause much interference with operation, since it was a short distance south of the old line. For the city there were advantages in the realignment and widening of Fifth St. to eliminate a bottleneck that throttled traffic and in the utilization of an abandoned canal that had become insanitary and an eyesore. In Fig. 1 are shown the plan and profile of the old and new locations. At the east end, track elevation ends at Dutoit St., where the railways diverge upon descending to the street level. Beyond this point further grade-separation work will be carried on by the individual railways.

Capitalized annual liabilities with the old line were estimated as follows: on the part of the public, $6,500,000 for delays to street traffic and $1,500,000 for accident damages not paid by the railways, or a total of $8,000,000, with no allowance for potential danger; on the part of the railroads, $3,290,000 excess operating costs due to the undulating profile, $135,000 for maintenance work on crossings and $500,000 for accident damages, making a railroad total capitalization of $5,395,000 and a grand total of $13,395,000. The total estimated cost of the improvement is $23,250,000, and the city has assumed the full 35 per cent share of this under the Ohio law.

Track and Traffic Study—To determine the number of tracks necessary, a chronological time table was made for all trains using the union station. From this it was found that there were 65 trains daily, with a maximum of seven trains in one hour. Similar studies were made of the freight traffic, and it was estimated that two

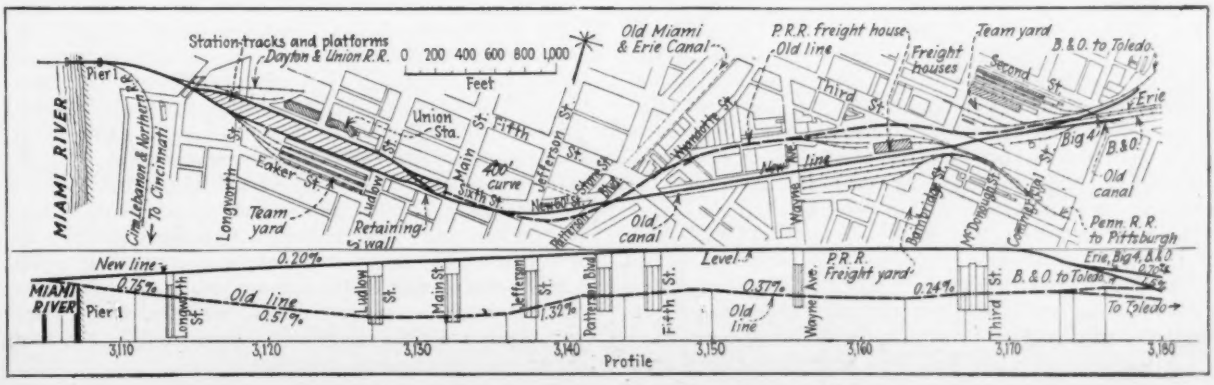


Fig. 1—Track elevation and relocation, Dayton, Ohio

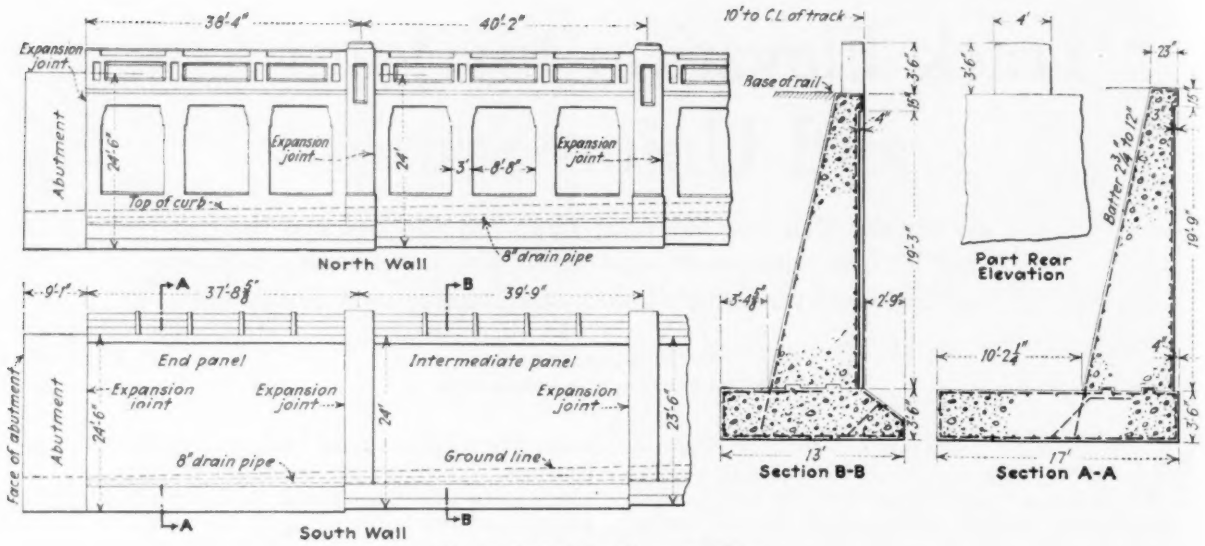


Fig. 2—Typical retaining-wall design

passenger tracks and two freight tracks could handle the traffic without difficulty for the next 50 years or more. As to this feature, the report of the Technical Advisory Corp. was substantially as follows:

There exists a fairly constant relationship between the population of a city and the number of daily passenger trains, provided that such city is what may be called a terminal. In Cincinnati, for example, there is one daily passenger train for every 1,700 persons, and this relation has not changed since 1880. The comparative figures are 2,500 for Louisville, 2,240 for Buffalo, 1,988 for Milwaukee and 3,122 for New Orleans. Obviously, no such relation between passenger trains and population exists in Dayton, which is not a terminal city, there being 45 through-trains as against 20 locals. Assuming that the principal cities served by the railroads passing through Dayton have a rate of growth equivalent to that of the last census decade, it will take about 54 years before the number of trains is doubled. Thus the daily number of passenger trains about 50 years from now will be 130, with about 14 in the maximum hour. If, for safety, it is assumed that two-thirds of these were bound in the same direction during the maximum hours, they would follow at 6-min. intervals.

Engineering Work—The first step was a transit and tape survey of the area to be covered. This survey was plotted on a scale of 40 ft. to the inch, showing the property lines, the four new tracks, the general features of the station and proposed changes, and the location of temporary tracks paralleling the old line from Ludlow St. to Wyandotte St.

In general, the elevated structure consists of concrete retaining walls of the counterfort type, with a fill of sand and clay. The filling material was hauled in 5- and 7-ton trucks, the movement and weight of which assisted in rolling and compacting the fill. Some of the fill was 20 ft. deep, and although a settlement of 12 in. was thought possible, the compacting action was so thorough that no appreciable settlement occurred. The retaining walls are placed mainly upon spread footings in gravel and other firm soils, but along the old canal bed there was about 7 ft. of muck. This muck was cleaned out, and reinforced-concrete piles spaced 2½ ft. c. to c. were driven to an average depth of 20 ft., but varying from 6 to 35 ft. Their tops were cut off and the footings and walls then poured. The material and compactness of the canal bed seemed to be extremely irregular, causing exceptional variations in depth to which the piles were driven, differences of 6 to 8 ft. in adjacent piles being common.

After the abutments had been poured, the steel erection was started at each intersection. The necessity of keeping trains moving while the work of reconstruction progressed made the work difficult. When pouring of abutments was started it frequently became necessary to work all night by floodlights.

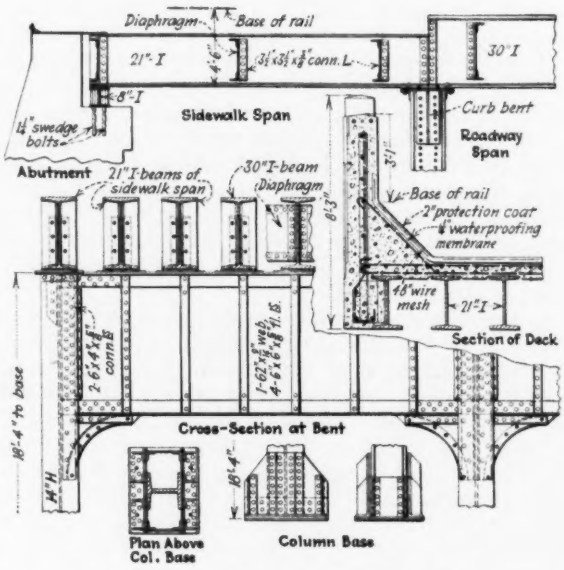


Fig. 3—Bridge at Main St. crossings

During all this construction the freight and passenger trains were using the old tracks up to Wyandotte St. (Fig. 1) and the detour tracks from there through Stone St. (which was closed to vehicle traffic) to the union station. Accommodation of vehicle traffic was accomplished by excavating half of each street at a time, thus permitting the other half to accommodate one lane of traffic in each direction. During the winter of 1930-31, when conditions prevented street work, asphalt and crushed rock were placed over the unfinished portions of streets to permit vehicles to make use of the full width until weather permitted the resumption of activities. The work of the entire project was so arranged that 80 per cent of the potential danger was eliminated by the first 20 per cent of crossings separated.

In the construction of its inclined approach to the

joint tracks of the Dayton Union Railway (Fig. 1) the Pennsylvania Railroad used coverings of canvas on a wood framework and the injection of live steam under the covering to permit the curing of concrete poured during winter conditions. A difficult part of the construction was at Longworth St., where an old elevated crossing was replaced by a new elevated single span at a higher level, the track grade being raised 3 to 7 ft. Here the Dayton Power & Light Co. blocked the major portion of the street while replacing underground conduits to its new steam plant, and further closing of the street occurred when steam shovels were employed to remove the old abutments. The south tracks were removed and new tracks placed on a 50-ft. clear span, the old 30-ft. span being then removed.

Retaining Walls and Bridges—The walls and abutments are of plain concrete, brush finished and having sufficient paneling to give a pleasing effect. Typical designs are shown in Fig. 2. On the north side the retaining wall is paneled and has a concrete parapet. The wall on the south side is of plainer design and is surmounted by an iron railing. Drainage is effected by 8- and 12-in. perforated, corrugated iron pipes laid along the walls and leading to the storm sewers at the underpasses. For temporary inclined approaches from street grade to the elevated tracks, walls of variable height built of precast concrete cribbing are used. Street grades approaching the subways range from 0.4 to 2.5 per cent.

There are eight bridges over streets. Most of these have steel bents at the curb lines and center of roadway, but the skew crossing of Third St. requires four bents, and the 50-ft. crossing at Longworth St. has no curb bents but a 50-ft. span covering the roadway and sidewalks. The widths between the abutments are mainly 68 to 107 ft., with 43 to 80 ft. between curbs and headroom of 14 to 15½ ft. Typical features of the Main St. bridge are shown in Fig. 3. Plate girders on the columns of the bents carry longitudinal I-beams upon which is the track deck, consisting of a 6-in. concrete slab with a three-ply waterproofing membrane protected by 2 in. of concrete reinforced with wire netting. The portal beams are embedded in concrete parapets, and the portal columns are cased with concrete, the parapets being paneled to continue the ornamental features of the retaining walls.

Tracks are laid with 130-lb. rails of A.R.E.A. section, with creosoted ties and stone ballast. At the station, however, the rails are carried by short blocks set in pockets formed in the concrete deck, (Fig. 4). A centrally controlled switch and signal installation will replace five small interlocking plants. Industrial connections and freight yards are left at street grade, with inclined approaches having grades of 0.5 to 1 per cent, except that a maximum grade of 5.5 per cent is required on the Pennsylvania Railroad connection for the Wayne Ave. yards at Bainbridge St. However, the new steam-power station of the Dayton Power & Light Co., on Longworth St., is served by a high-level spur track.

Union Station—The present station, erected in 1900 (*ENR*, Aug. 8, 1901, p. 22), provides ample facilities and required only certain alterations to suit the change of track level. As altered, it has six passenger tracks and three island platforms 18 ft. wide. The two freight tracks are outside the passenger tracks, and on one side there is a track for sleeping cars outside the freight track. Platform shelters are of the butterfly type, supported by steel columns having T-heads 17½ ft. wide to carry a concrete roof 22 ft. wide. For the 12-ft. platform serving the sleeping cars the columns have 7½-ft. T-heads carring a 12-ft. slab. At the elevators and stairways there are four light-steel columns at the corners of the opening. These shelter roofs are of precast concrete slabs with asphalt filler in the joints and have a four-ply waterproof covering. Their copings are covered with a film of lead sprayed on as a protection from smoke and weather.

At street grade under the tracks there is a concourse 90x150 ft., connected with the waiting room and having six stairways to the platforms. There are no passenger elevators to the platform. Space for baggage, mail and express is arranged at either end of the concourse.

Old Canal Bed Used—The railroads desired to use the old Mad River feeder canal for right-of-way in order to secure an improved alignment, but it could not be done without special legislation. In 1925 a bill was passed authorizing the state to abandon the canal right-of-way for canal purposes. This was supplemented in 1927 by a bill authorizing the city to purchase that part of the canal within city limits and at the state's appraisal. Finally, a third bill passed in 1927 gave municipalities the right to acquire property for grade separation and sell it to the railroads. All the necessary property was acquired without a single condemnation suit being filed. This canal is now occupied by the elevated structure west from Jefferson Ave. to Front St., the latter being beyond the portion of the city shown on Fig. 1.

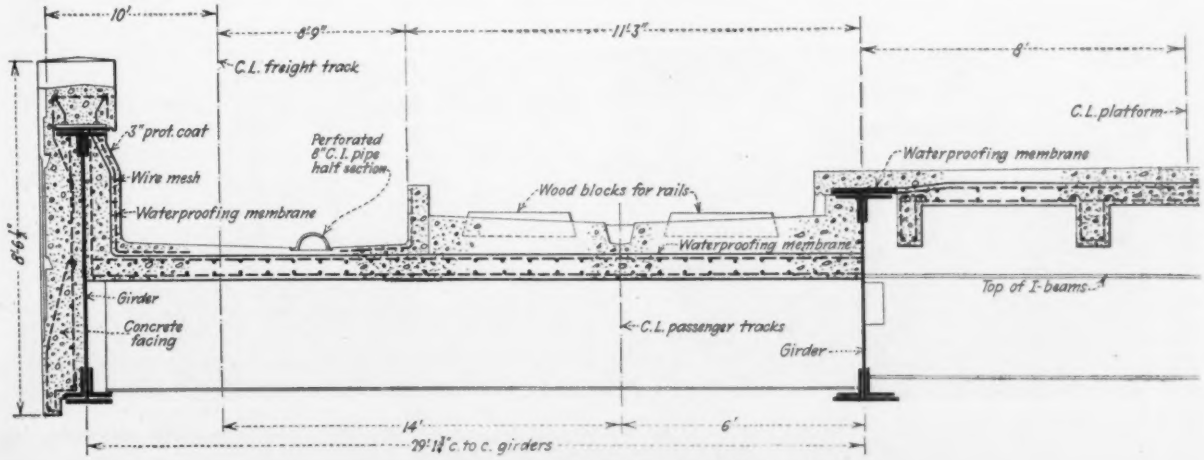


Fig. 4—Track floor in union station

With the canal thus closed, it was necessary to build an 84-in. stormwater intercepting sewer about 3 miles east of the joint tracks to carry the flow from several small sewers that had discharged into the Dayton hydraulic canal and thence into the feeder canal. This sewer, 6,770 ft. long with an 1,860-ft. branch to the east along Springfield St., discharges into Mad River and is fitted with bolted manhole covers to resist inside pressure with the sewer running full. A similar sewer is proposed on the north side of the tracks. The total cost of sewer work made necessary by the grade separation was about $400,000, of which the railroads paid 65 per cent and the city 35 per cent, the same allocation that was made on other parts of the work.

Engineers and Contractors—To carry on the work of this joint line, J. D. Moffat, then assistant engineer of the Pennsylvania Railroad, was made chief engineer of the Dayton Union Railway, with F. D. Lakin (formerly of the Erie Railroad) as assistant engineer. For the city the work was under the direction of F. O. Eichelberger, city manager, and John F. Hale, city engineer. Karl Woditsch, assistant city engineer, was in direct charge. The M. E. White Co., Chicago, was general contractor for the elevated structure, and the Republic Asphalt Paving Co., Dayton, for the street work. Steel for the bridges was furnished by the American Bridge Co., and that for the station shelter sheds by the Dayton Structural Steel Co. The first train was operated over the new line on Dec. 15, 1930. Work is now practically completed on the first section, comprising all the joint tracks, but the permanent inclined approaches from freight yards and industries will be built and grade separation carried out on the lines of the individual railroads between 1932 and 1936.

Shipping and Erecting 154-Ft. Plate Girders

By SHORTRIDGE HARDESTY
Waddell & Hardesty, Consulting Engineers, New York City

THE WEST APPROACH of the high-level suspension bridge now being built over the Maumee River in Toledo, Ohio, contains a 154-ft. deck-plate-girder span crossing over several railroad tracks. Plate-girder construction was adopted for this span partly to harmonize with the appearance of the remainder of the approach, and partly because it was considered to be preferable to trusswork for a span over tracks.

Dimensions and Materials—The two girders in the span are 153 ft. 10¼ in. long and 12 ft. 1 in. deep over all, and weigh 168,000 lb. each. Both flanges consist of two 8x8x1⅛-in. angles, two 12x⅝-in. side plates and four 19-in. coverplates. The web is 138 in. deep and $\frac{9}{16}$ in. thick, and it is stiffened with 6x4- and 6x3½-in. angles. The flanges, webs and end stiffeners are of silicon steel, the rest of the metal being carbon steel. The girders are set 43 ft. apart transversely and have pin bearings on cast-steel rocker pedestals 152 ft. 6¾ in. apart. The floor beams are 60 in. deep and have their top flanges flush with those of the girders. The sidewalks and the outer portions of the roadway are carried on solid-web cantilever brackets 11 ft. 7 in. long. The roadway is 54 ft. wide between curbs, and the sidewalks are 6 ft. wide.

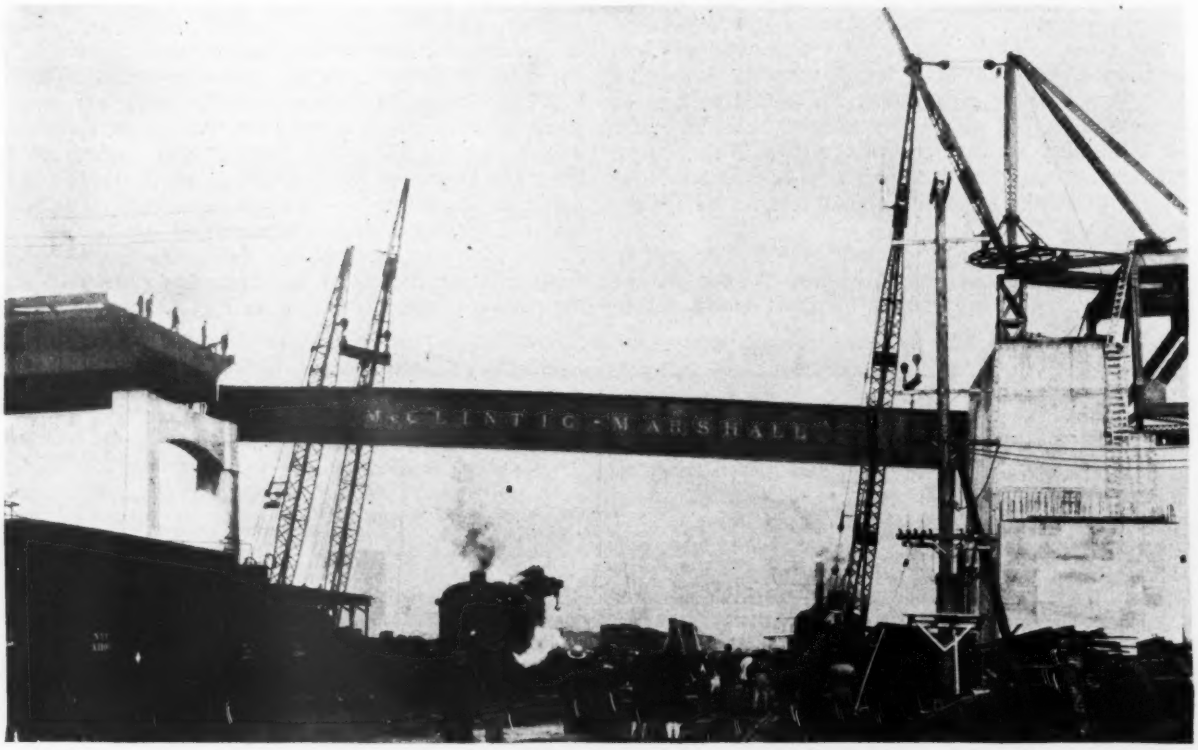


Fig. 1—Lifting a 154-ft. plate girder into position in the approach to the new Maumee River suspension bridge at Toledo

Two 60-ton locomotive cranes handled one end, while a 40-ton locomotive crane and a 20-ton stiff-leg derrick lifted the opposite end. The wrecking crane shown unloaded the girders from the four flat cars upon which each was received.

The total weight of the span is 580,000 lb., and the total dead load, including the deck, is 2,028,000 lb. The span was designed for a live load of 20-ton trucks, the maximum moment in each girder being 27,840,000 ft.-lb., and the gross flange area of each flange being 119.59 sq.in.

Fabrication and Shipping—The girders were fabricated complete at the Leetsdale plant of McClintic-Marshall Corp., near Pittsburgh, and they were assembled vertically with 3-in. camber. They were riveted with the webs in a horizontal plane. Each girder was loaded on four flat cars with bolster bearings 117 ft. apart. As the girders required a vertical clearance of 17 ft. 1 in. above the tops of the rail, the possibility of shipping a girder of such dimensions to Toledo was verified before the design was made. The bolster bearings, which were bearing on the car floor, but they were provided with bearing plates across their lower flanges that had ¼-in. clearance with bed plates 5 ft. long parallel to the girder on the car floor.

Unloading—Since the girders blocked the right-of-way at the bridge until the erection was completed, it was necessary for the field work to be carried out as quickly as practicable. The girders were unloaded successively by a railroad wrecking crane with a seven-part hoisting tackle suspended from the middle of its boom. The lower block of the hoisting tackle had a double hook that engaged two 4⅞-in. pins through the webs of a lifting beam composed of a pair of 24-in. I-beams about 7 ft. long, the lower flanges of which were connected to the top flange of the girder by 28 1-in. Mayari steel bolts passing through open-flange rivet holes.

After the lifting beam had been connected, it took 15 min. to lift the girder from the cars and haul it a short distance down the track to clear, and 15 min. more to swing it by means of tag lines into position whence it could be picked up by two 60-ton cranes with 80-ft. booms, which shifted it to the position required for erection. From this position it was lifted about 67 ft. and placed on its shoes in 20 min.

Erection—Each girder was hoisted by the

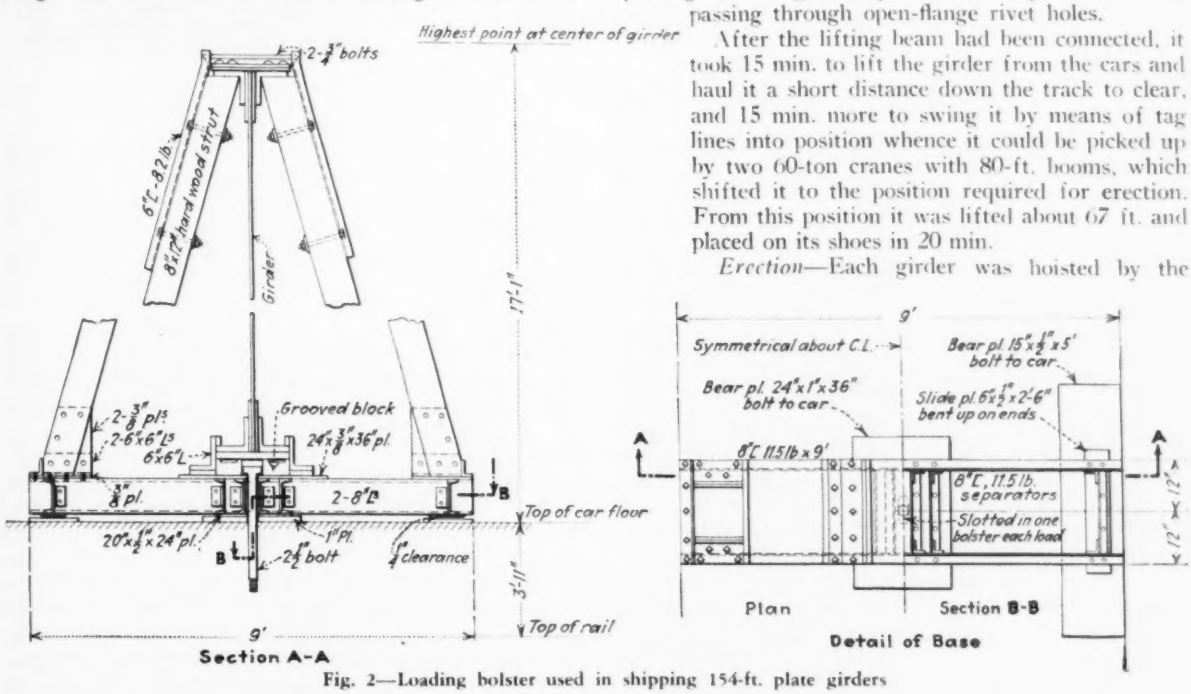


Fig. 2—Loading bolster used in shipping 154-ft. plate girders

located near the centers of the end cars, were each designed to carry one-half of the girder weight and to provide for the swiveling of the girders when passing around curves. Each bolster (Fig. 2) consisted of a pair of 8-in. channels 9 ft. long and 24 in. apart, connected by vertical transverse webs at the center and ends. At the center a 2½-in. vertical pivot bolt passed through a cover-plate, with a nut on the lower end screwed up to bearing against the car frame. A pair of hardwood blocks, grooved to clear the flange rivet heads, provided bearing on the bolster for the bottom flange of the girder, which was securely held in position by angle clips bolted to the bolster to prevent transverse or vertical displacement of the girder flange. Center bearing for the bolster was provided by a 20x24x½-in. deck plate on the car floor, through which the pivot bolt passed.

At each bolster there was provided a pair of inclined 8x12-in. transverse timber struts, with the upper ends cut to bearing against the lower surface of the top-flange angles of the girder. These braces were secured at the bottom by bolts passing through gusset plates riveted to the bolster, and at the top by tiebolts just above the top flange of the girder that passed through the upper ends of 6-in. channel scabs bolted to the upper faces of the struts. Normally the ends of the bolsters did not take simultaneous operation of two 60-ton locomotive cranes at one end and a 40-ton crane and a stiff-leg derrick at the other end. The hoisting attachments were so spaced that the locomotive cranes lifted 25 tons each, the 40-ton crane 15 tons and the stiff-leg derrick 19 tons. The 60-ton cranes were on opposite sides of the girders at one end, and the 40-ton crane at the other end was on the opposite side of the girder from the derrick installed on the pier. At each end of the girder the pair of hoisting tackles were attached to opposite ends of a lifting beam with a pair of hooks at the center that engaged the top flange of the girder. The unloading, shifting and erection of each girder was accomplished in less than one hour by ten men and a foreman.

The bridge is being built by the city of Toledo, under the direction of Wm. H. Schroeder, director of public service. It was designed, and its construction is being supervised by Waddell & Hardesty, consulting engineers, New York City. The superstructure is being fabricated and erected by the McClintic-Marshall Corp., which developed the erection schemes and details.

The bridge is to be completed in September, at a cost of about $3,000,000. The main suspension span over the river channel is 785 ft. long, and the total length from abutment to abutment is 3,215 ft.

Determining Clamshell Bucket Characteristics

Proper size for required output or capacities of various sizes for digging and rehandling of all materials can be determined from charts and tables

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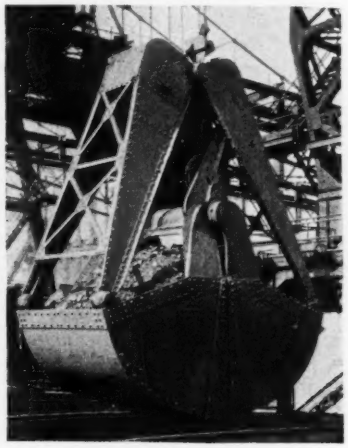


The world's largest grab bucket, rated at 450 cu.ft. capacity

LITTLE IS KNOWN by the average user of the clamshell or automatic grab bucket of its design and performance characteristics. In the fairly short period of rapid development and widespread adoption of the grab (occurring in comparatively recent times, although it was first introduced into this country about 1848) a wide variety of designs and types of buckets have been produced. While these vary greatly in individual features, all well-designed grabs establish a definite relation between weight of bucket, capacity, digging power and gross load, the last affecting the operation of the crane, of which the grab is but an agent. This article will show that these various relations and characteristics can be determined from charts and tables, the use of which will enable the proper selection of a grab for a particular job or the determination of expected efficient performance from existing plants.

A careful study of the characteristics of the grab bucket itself has resulted in tangible data and relatively simple methods for estimating the capabilities of a grab in relation to the particular class of work to be done. These data are equally applicable to existing or proposed material-handling plants and may be used as a basis for determining the proper relation between crane and grab in respect to weight, size or type of the latter and the amount of material to be handled.

Efficiency in a grab bucket comprises the ability to pick up a required amount of material, with a minimum of dead weight, in the shortest space of time. However, the grab must also possess the strength and rigidity to withstand every condition of use and abuse, for any serious interruption in the bucket operation is likely to be attended by economic losses far exceeding the value of the grab itself. In this respect the problems presented in the design of a grab bucket are akin to those of the airplane; all material entering into its construction may be subject to stresses beyond the ordinary limits of engineering practice, and the consequences of failure are severe.

In general, it should be remembered that the most satisfactory results will always be obtained by specializing the grab as far as possible, by adapting it carefully to the conditions required in each installation.

Fig. 1—Another Leviathan among buckets. A special coal handler with a jaw spread of 24 ft.

The first important characteristic in a grab is digging power. This quality, inherent in the design, is shown by the ability to force the cutting jaws down into whatever material is to be handled, in spite of the fact that the operating cable leading to the crane is constantly exerting an upward pull on the grab. The tension in the closing cable is always proportional to the cutting resistance of the material and inversely proportional to the ratio of power multiplication provided in the internal closing mechanism of the grab, as movement of the cutting jaws can result only from the pull of the closing cable exerted through the internal mechanism.

It follows that the greater the resistance to penetration of the material the greater will be the required pull of the operating cable, which may eventually become built up to a point exceeding the weight of the entire grab, thus causing the jaws to rise out of the material and to close without picking up a profitable load. In such a case the net weight on the cutting jaws must be increased, either by increasing the power multiplication ratio (or speed reduction) of the bucket mechanism, or by adding weight to the bucket, or both. An increase in the power ratio will involve a greater difference in speed between the closing cable leaving the head of the bucket and the horizontal movement of the jaws toward one another, requiring longer time for closing the bucket.

Another factor affecting digging ability is the total distance through which the cutting jaws of the grab travel between the open and closed positions; the greater the travel the more material will be picked up, provided the power ratio when the jaws are at or near the closed position is sufficiently high to prevent the grab lifting out of the increased material.

The next consideration for successful performance is the proper relationship between the grab and the crane, considering the maximum gross weight of the bucket and the lifting capacity of the crane. Usually the lifting power of the crane is known or may be readily determined, but the gross load, or combined weight of the grab and material, varies widely with different classes of work, and it

will be found that surprisingly few data are generally available on this vital point. For instance, the average gross weight of a 2-yd. grab handling coke is about 6,500 lb., while that of a grab of the same rated size working in iron ore will exceed 20,000 lb. And, in most cases, the gross load cannot be arrived at simply by determining the weight of the empty bucket and the weight per cubic foot of material, because sometimes the grab will overfill its scoop by 50 per cent or more, while in other materials it may handle only one-third of its rated capacity.

The value of proper control of the gross load cannot be overemphasized. If the loaded bucket is too heavy,

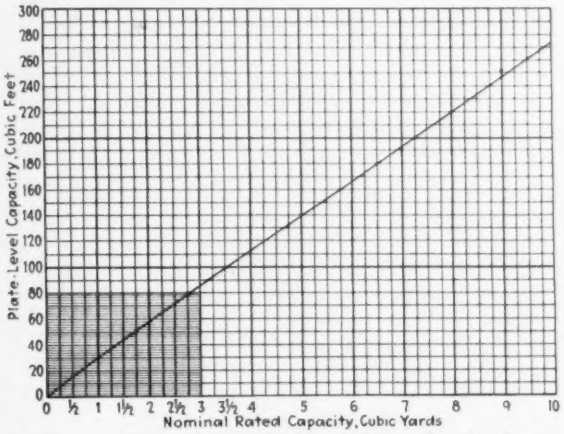


Fig. 2—Suggested standard relation of plate-level capacities to rated sizes of grab buckets

the hoisting machine will be slowed up; and in the case of a revolving jib crane the operating radius of the boom must be reduced. On the other hand, if the grab should be too small or light, the amount of material moved will be limited. In either circumstance the investment in the crane will fail to return proper dividends. A further consequence may be a slowing up of the normal rate of activity of an entire construction organization or industrial plant, by lack of sufficient output of raw material by the crane.

Rated Capacities

Grabs are generally rated on the basis of the struck-level measure of the scoop plates; but as yet no uniform standard has been adopted by the various bucket manufacturers to fix the relation between rated size and the actual cubic capacity in material handled. An illustration of this fact is found in the published plate-level measures of two grabs of standard make, each rated at 1½ cu.yd.; one holds less than 40 cu.ft. of material and the other more than 60 cu.ft. Thus, two grabs of approximately the same weight, length, width and power ratio will pick up practically equal quantities of material under like conditions; but if one of the grabs is equipped with scoops of 50 per cent greater struck capacity than the other, the observer's eye will be deceived, inasmuch as one grab will appear to be filled to overflowing and the other to be only partly filled by the same amount of material.

Standard Relationship Urged

In the hope that it may lead eventually to the adoption of more uniform standards for the rating of grab buckets, a curve defining a practical relation between the plate-level capacity and the nominal size of the bucket, in cubic yards, is presented in Fig. 2. This is based upon the amount of small crushed stone (¾ in.), which a grab of good design will be able to pick up under proper operating conditions. It is a rounded load, the contour of which should be used as a guide in proportioning the side plates of the scoop. A scoop so shaped will be found suitable for handling any heaped load of easier digging materials without spilling. In studying the curve it will be noticed that the plate-level capacities of the smaller grabs are slightly greater than the nominal ratings. The reason is that established American practice is to make the smaller grabs somewhat heavier in proportion to rated size than the larger ones, which correspondingly increases their digging ability.

The next step is to provide a method for determining the actual gross loads of buckets of various types and operating in a number of different materials commonly associated with grab bucket work. For this purpose field tests were made, using a small portable scale outfit to weigh both the bucket and load while suspended on the crane cables (Fig. 3).

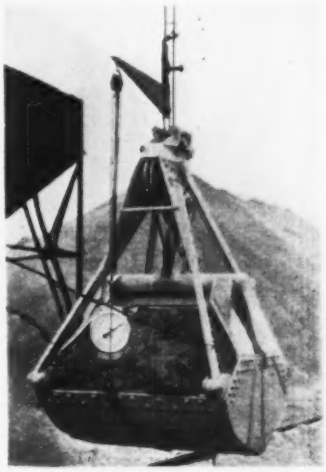


Fig. 3—Scale rig for determining actual gross weight of bucket and load

A compilation of the test results is given herewith in the form of typical curves, accompanied by a table of qualifying factors to take care of different materials and types of grabs. While these data may not be strictly applicable to any specific bucket, they serve as a guide to what may be expected under average conditions of service with buckets properly suited to the work to be done.

The curve in Fig. 4 shows the relation between rated size (in cubic yards), and gross load (in pounds) for grabs of the dredging type working in soft wet clay, including an allowance for suction at the moment that the jaws are lifted out of contact with the material. For other grabs and materials, readings from the curve in Fig. 4 are to be qualified by means of the factors in Table I. Here, the first column specifies average weights, in pounds per cubic foot, for each of the materials listed in the second column. Opposite each class of material, in the third column, are shown the particular types of grab bucket that may be used. The terms there used have the following meanings:

A general purpose grab is one that is adapted both for rehandling of granular materials and for ordinary excavation work. It is of medium weight, slightly heavy for the former class of work and light for the latter, but it proves economical where the crane must be transferred frequently from one job to another.

The *clean-up* type is ideal for rehandling loose granular materials such as sand, small stone or coal. It is about 20 per cent lighter than the general purpose grab and has greater width and open length to facilitate cleaning up the floors of cars and barges.

The rehandler type is the same as the general purpose in dimensions, but it is about 30 per cent lighter and usually is of low power ratio. This makes it fast in operation, but it should be used only for rehandling light easy-digging materials.

The dredger, heavy dredger and extra heavy dredger types are similar to the general purpose in dimensions, but they are built with greater weight in the proportions indicated by the factors in column four. Grabs of this class are used for hard-bottom dredging work, stiff clay excavation, large stone, and riprap, etc.

The bridge-type grabs are of the four-line class, operated by means of two closing cables and two holding cables, and they may be run in the bight of the line if required.

Iron ore grabs are commonly provided with a double-hinge shaft, so as to obtain longer travel of the jaws through the ore without increasing the over-all height of the bucket. They are also made extremely heavy in order to penetrate the ore, which is one of the most difficult materials to handle.

Grabs for the handling of snow are extremely light in weight and low in power ratio. They are of special construction to permit their operation on small cranes with low clearance under the boom.

The factors shown in the fourth column of the table cover the weight of the empty grab, in each case using

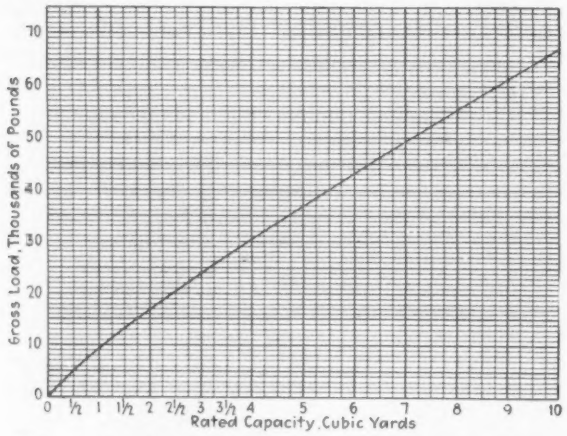


Fig. 4—Relation of rated capacity to gross load. Curve based on dredging-type bucket working in soft clay. Factors given in Table I must be applied when considering other buckets or materials

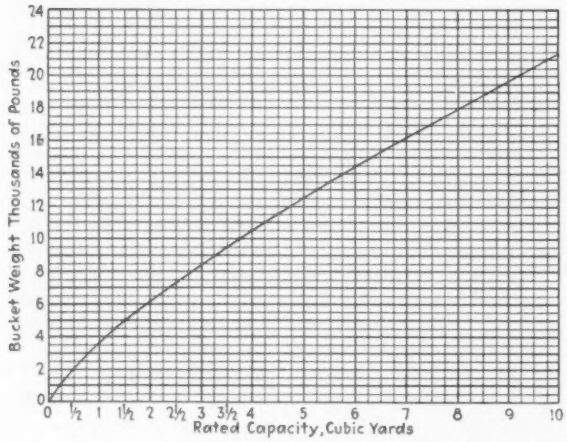


Fig. 5—Relation of rated capacity to bucket weight. Curve based on general-purpose bucket. Factors given in Table I must be applied when considering other buckets

as a basis the weight of the general purpose bucket. This basic weight is obtained by the empirical formula:

$$W = 236\ (C-5)^{4/5} + 855$$

where W is the weight of the empty bucket (in pounds) and C is the rated capacity (in cubic feet). Weights obtained by this formula and the factors in column four will be found to vary in practice up to 3 per cent, but in general they have been proved to be applicable to all correctly designed grabs from 2- to 450-cu.ft. capacity. This formula has been plotted as a curve in Fig. 5.

The factors in column five of the table are intended to adapt the readings from the basic curve, Fig. 4, to specific classes of work. For example, let us assume that a 6-yd. grab of the clean-up type for handling sand is being considered, and it is required to find the maximum gross load that such a bucket will impose on the crane. The curve, Fig. 4, for 6-yd. capacity gives the gross load figure of 43,000 lb. Multiplying by the factor 0.72, from column five of Table I, determines the gross weight of the 6-yd. clean-up bucket in sand

TABLE I—BUCKET FACTORS FOR VARIOUS MATERIALS

1	2	3	4	5
Lb. per Cu.Ft.	Class of Material	Type of Grab Bucket	Weight Factor	Gross Load Factor
65	Acid phosphate	General purpose	1.00	0.54
		General purpose with short, wide teeth	1.04	.60
33	Ashes and cinders	Rehandler	.70	.41
50	Coal, run-of-mine	Light bridge	.96	.51
		Cleanup	.80	.47
50	Coal, slack	Rehandler	.70	.47
		Light bridge	.96	.55
		Cleanup	.80	.53
33	Coke, small	Rehandler	.70	.38
		Cleanup	.80	.46
144	Clay, soft, with suction	Standard dredger with teeth	1.28	1.00
		Heavy dredger	1.75	1.25
		Extra heavy dredger	1.90	1.35
95	Clay, hard-packed	Standard dredger—teeth	1.28	.65
105	Earth excavation	Standard dredger—teeth	1.28	.80
150	Iron ore	Bridge, double hinge	2.00	1.25
85	Limestone, stl. mill	Extra heavy dredger	1.90	.80
165	Manganese ore, 2-6in.	Bridge, double hinge	2.10	1.12
100	Nitrates	Bridge	1.15	.75
60	Phosphate rock	General purpose	1.00	.51
165	Pyrites	General purpose	1.00	1.00
100	Sand	Rehandler	.70	.65
		Cleanup	.80	.72
		General purpose	1.00	.76
		Standard dredger, no teeth	1.22	.89
35	Snow	Special design	.45	.28
90	Stone, ¾-in.	General purpose, plate-level rating basis	1.00	.60
		Cleanup	.80	.61
90	Stone, 1¼-in.	General purpose	1.00	.64
		Standard dredger, no teeth	1.22	.75
85	Stone, 4-6 in.	H'vy dredger, with thin teeth	1.75	.79
75	Stone, one-man	Extra heavy dredger	1.90	.75

as 31,000 lb. Conversely, if it is known that the crane is able to handle a total load of 31,000 lb. and it is desired to find the maximum clean-up grab that would be practicable for handling sand: dividing the actual gross load of 31,000 lb. by 0.72 gives an equivalent gross figure of approximately 43,000 lb., which, from the curve, indicates that the rated size of the bucket should be 6 cu.yd.

Having thus determined the rated size of the grab to fit the conditions given, the weight of the empty bucket is next found by referring to the curve Fig. 5. This curve shows the weight of a 6-yd. general purpose bucket to be about 14,400 lb., which, multiplied by the factor 0.80 (from column four of the table) indicates that the weight of the clean-up type grab in this size will be 11,500 lb.

Subtracting the weight of the empty grab from the gross load establishes the actual weight of material that will be picked up. In the above example 31,000 — 11,500 = 19,500 lb. of sand, or 195 cu.ft. @ 100 lb. per cu.ft. This is the actual capacity of the 6-yd. bucket in this material, although its plate-level rating, as given by the curve in Fig. 2, is only 166 cu.ft.

All of the above data are based on the asumption that the grabs will be designed and reeved so as to develop sufficient digging power for the particular material in which they are to be used. This quality may be determined, for all practicable purposes, by calculating the ratio between a unit pull on the closing cable and the horizontal force developed, as a result, between the lowest points of the cutting jaws with the bucket in

closed position. Experience has shown that there are certain minimum values for this ratio, which must not be decreased if the grab is to perform satisfactorily in either plastic or loose granular materials. The usual range of this ratio, from maximum to minimum, is given for the several principal classes of work:

Rehandling sand, coal and easy-digging materials	0.90 to 0.40
Rehandling crushed stone or lumpy materials	1.20 to 0.70
Light excavating	1.30 to 1.00
Heavy excavating	1.50 to 1.20
Digging iron ore	2.00 to 1.30

In handling large irregular pieces of rock no grab can dig down to any extent, and the power ratio becomes secondary to the weight and open spread of jaws.

Teeth are useful in all plastic or compacted materials, acting to scarify the surface at the beginning of the stroke and to anchor the jaws down during the last portion of their travel. They also serve as grapples for holding large pieces of rock. In general, the teeth should be made of heat-treated alloy steel to permit the use of as slender a cross-section as possible and to reduce wear on the points to a minimum.

A method for comparing the digging characteristics of two different grabs is described as follows: First, the power ratio (ratio between the closing cable pull and the horizontal force between the extreme points of the cutting jaws) is calculated at various points throughout the stroke, starting from the wide-open position of the jaws. Then, beginning at zero for the extreme wide-open position, multiply the ratio at each point by the distance the jaws travel from zero to reach that point. The product will indicate the distance that the cutting edges will penetrate below grade; since the calculations are intended for comparison only, these depths may be plotted to any convenient scale.

Plotting successive points in this manner will produce a curve representing the profile cut that will be made by one side of the bucket. A similar profile may then be computed for the second bucket, and a comparison of the areas of the profiles will show the relative digging ability of the two grabs in all materials, excepting those that are so easily penetrated that they will spill out over the tops of the bucket scoops. The profile study will also serve to show whether the jaws will have a tendency to lift out of the material before the close of the stroke due to insufficient closing power in proportion to length of stroke.

Wire Ropes

The maximum size of wire rope that it is practicable to reeve through a bucket has an important bearing on the construction of large grabs. Cables up to and including 1½ in. in diameter are commonly used for large grabs having only one closing cable; but if the gross load cannot be handled by a single cable of this size, two closing lines and two holding lines must be employed. This grab is known as the four-line type.

Four-line buckets are occasionally operated on revolving jib cranes but more often on installations of the bridge or traveling-gantry type of crane. In such cases the four cables also serve to prevent the grab from twisting while it is being hoisted, a condition that cannot be controlled in any other manner when the length of the crane runway is beyond the range of a tag line.

Bearings

The principal item of upkeep on buckets usually consists in bearing replacement. Anti-friction bearings of either the ball or roller type have been employed to some extent during the past few years for grab bucket sheaves. Such bearings are now considered to be essential in grabs that operate on rope-trolley bridges having a trolley-travel speed of 1,000 ft. per minute or more, because of the excessive heat generated in plain bushed bearings under such conditions.

In the ordinary two-line grab no extreme cable speeds exist to justify the expense of anti-friction-type bearings. In cases where the grab is to operate in highly abrasive materials the lower sheaves may be equipped with anti-friction bearings in order to permit the use of grit seals, which could not otherwise be applied because of the normal play found in plain bushed bearings. However, if grit seals are used, they must completely protect the bearings, for many an expensive ball or roller bearing has been ruined because of poor design of the grit seal.

For this reason, probably the most practicable and least hazardous bearing construction for general work is found in the use of plain bushings made of extremely hard material, which will not become scored even by contact with the most abrasive substances. Such bearings are not dependent for their life upon the more or less delicate construction of grit seals; and if the shaft on which the hard bushings operate is of tough steel a few degrees softer than the bushings, all wear will be confined to the shaft itself, which may be replaced at a small cost.

Sheaves

A further important item of upkeep cost in grab bucket work is the operating cable. Extensive tests have shown that if the sheave grooves are of hard metal to prevent scoring by the strands of the cable, the rope will last longer than if the sheaves are of soft metal. The reason is that the cable stretches rapidly soon after being placed in service; the scoring of the sheave grooves is therefore made to the pitch of the old, or stretched, cable. When a new cable is reeved in, the pitch of its strands does not mesh with the score of the groove, resulting in early damage to the rope. The second major cause of short cable life is chafing against non-rolling surfaces, which must by all means be avoided.

Germans Develop Artificial Pumice for Hollow Building Blocks

A new building material consisting of artificial pumice has appeared on the German market, according to a report received in the U. S. commerce department from its Berlin office. Hitherto only natural pumice has been used for building material of this type. Numerous experiments have shown, according to the Germans, that this material has many advantages over the natural pumice sand, a fact of great importance in transportation. In addition, it is claimed that it is an excellent fireproof material and that it can also be used to advantage as a concrete admixture, needing only to be thoroughly moistened to obtain a satisfactory binding with cement. Sheets of concrete using the substance as a component are produced in thicknesses of 10 centimeters and can be easily cut out and shaped. It is also said to be a good base for linoleum. The main use intended for the new material is in the manufacture of hollow blocks. As it is reported to be cheaper and lighter than brick, the German building trade expects that its use will be of considerable economic advantage.

ENGINEERING LITERATURE

A Monthly Review of Books and a Listing of New Publications

Policy and Ethics in Business

POLICY AND ETHICS IN BUSINESS—By Carl F. Taeusch, Associate Professor of Business Ethics, Managing Editor, Harvard Business Review, Graduate School of Business Administration, Harvard University. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. 624. $5.

BUSINESS is not alone a fascinating study but one of vital importance. For this reason any book that leads to better understanding of its problems deserves to have many readers. And perhaps it will have the most fruitful effects if it supplies definite information, leading to conclusions that will work in practice.

There are two lines of approach to the subject. Business may be considered as a series of mechanical processes, more or less rigidly determined by economic factors. Or it may be considered as a process directed by a policy—a process, therefore, which may be right or wrong. The right or wrong of business, or the ethics of business policy, has been little explored so far. Yet many of the problems of the executive today depend less on current business practice than on the broad principles of what may be called business ethics. This is so, for instance, in respect to competitive bidding and commercial bribery.

In answer to this need, Prof. Taeusch, of the Harvard Business School, has written a book which, though bulky in appearance, contains a wealth of relevant material. "Policy and Ethics in Business" contains numerous cases taken from court and Federal Trade Commission reports which, supplemented by the decisions and appended comments, cover all the sore spots in present-day business competition. There are sections devoted to unfair trade practices and the ethics of price policies, and others devoted to the more orthodox subjects of business and the Sherman law, and the ethics of self-regulation in business.

Throughout the book there runs a general thesis, which is nowhere explicitly stated. It is this: The duty and rights of any business enterprise rest upon its relation to industry as a whole—not on the prosperity of the individual industry (which relation would lead to a capitalistic philosophy), nor on the interests of the consumer (which would lead into Marxism and a proletarian philosophy). In other words, that policy is ethical which leads to the soundness of all business. Application of this principle, the author indicates, will yield equal benefit to the producing and the consuming classes, the latter in superior quality and dependability, if not directly in lowered prices. The principle obviously is not as idealistic as at first glance it may appear, since today everyone is both consumer and producer.

Ever-Changing Construction Costs

ESTIMATING BUILDING COSTS—By Frank E. Barnes, C.E., M.Am.Soc.C.E., M.A.A.E., Building Valuation Engineer of the New York Central Lines. Third edition. New York and London: McGraw-Hill Book Co., Inc. Flexible; 5x7 in.; pp. 656; many halftones, line cuts and tables. $5.

CONSTANT changes and improvements in building design and construction procedure require corresponding changes in estimating building costs. The principal revisions in the third edition of Barnes' volume "Estimating Building Costs" pertain to heating and ventilating systems, which have been subjected to great improvement in the past few years. Recognizing that many of the items going into the construction of a new building are patented or trade products, the author has wisely devoted much space to describing them and estimating their installation costs. As appraisal of buildings is often part of the building estimator's work, a complete chapter on this subject is included. All estimates are given in man-hours, which can easily be converted to costs with the aid of the handy wage table included in the volume. Many other useful data used constantly by the estimator are found in a special chapter. Altogether this work is above the average of its kind.

Rust and Anti-Rust Painting

REVIEWED BY DR. A. H. SABIN
Consulting Chemist, National Lead Co., New York City

ROSTSCHUTZ ROSTCHUTZANSTRICH für Bauingenieure und Baufashleute Physiker und Chemiker—Von Hermann Suda und Heinr. Salvaterra, Professor und Privatdozent an der Technischen Hochschule, Wien. Vienna, Austria: Julius Springer. Cloth; 6x9 in.; pp. 344; 193 line cuts and halftones. 24 marks.

THE design of "Rust-Prevention and Anti-Rust Painting" as the title of this book reads in English is to bring together in a simple and connected way information about the received theories of rusting and descriptions of paint materials. Under materials, 40 pages are given to oil, chiefly linseed, 50 to pigments and 15 to volatile thinners. Attention is confined to those materials used in metal painting. Thus about 10 pages of the section on pigments are given to red and white lead, 6 to zinc pigments, 5 to iron oxide and 2 each to titanium and the so-called inerts, or fillers as the authors term them.

The chemistry of the oils, and especially the changes in drying, is reasonably full, and it is noticeable that it is the obvious intent to use familiar language even in describing things of scientific complexity, which is helped by copious footnotes and ample references to original papers. This excellent principle, to make theoretical discussions intelligible to the not highly specialized reader, is characteristic of the whole book. The authors everywhere try to give the opinions of experts, but do not take sides or make decisions on doubtful matters. There will be readers to whom a more polemical treatment might give more definite notions. It is impossible to please everybody.

There is a considerable section on testing paints. To the present reviewer this seems in considerable part more suggestive than practical. There is a nearly irresistible desire on the part of would-be experts to develop a quick way of getting long-exposure results, generally by some mechanical device to subject the film to the recurrent action of water, drying, heat, cold, ultra-violet light, and so on. The enthusiastic inventor always gets desired results, but the next research man presents something new. Considerable space is given to these things, which by this time are out of date. The book gives them impartially, and perhaps they stimulate research.

There is a copious index to the literature of the subject; notable, like most indexes, equally for the worthless

stuff it includes and the useful that it overlooks. For instance, one of the authors of this book has written much new and instructive matter on iron oxide, but one would not find it, except in scanty footnote references; and some of the most generally used paints have but slight mention.

The book is a well-written, interesting guide to the engineer who wishes to investigate matters relating to structural painting, but avoids stating conclusions. The reader will seldom find a satisfactory answer to his question, but he will get the varying views of it, not intentionally confusing, and many references to original papers of more or less value.

Hydraulics Up to Date

REVIEWED BY I. GUTMANN
Associate Editor, Engineering Index, New York City

ANGEWANDTE HYDROMECHANIK—Von Dr.-Ing. Walther Kaufmann, O. Professor der Mechanik an der Techn. Hochschule Hannover. Erster Band. Einführung in die Lehre vom Gleichgewicht und von der Bewegung der Flüssigkeiten. Berlin: Julius Springer. Paper; 6x9 in.; pp. 232; 146 line cuts. 12.5 marks in paper; 14 marks bound.

SUCH concepts and methods as Reynolds' number, similitude, and velocity potentials, which are hardly if ever mentioned in American college courses, have acquired a place in European hydraulic literature.

The chances are that with the rapidly growing scope and importance of hydraulic laboratory research, requiring utmost refinement and a degree of precision unmatched in large-scale work—these newer methods will become a matter of necessity. Witness their use in the highly practical studies described in John R. Freeman's "Hydraulic Laboratory Practice" and in the *Transactions* of the hydraulic laboratory of the Munich Institute of Technology, soon to be published in English translation by the American Society of Mechanical Engineers. Also see H. Kulka's application of potentials and conformal representation to the design of movable weirs. (Reviewed in *ENR*, March 21, 1929, p. 475.)

Undoubtedly the "new" hydraulics has come to stay. Prof. Kaufmann's "Hydromechanics" will be found a good "guide for the perplexed." The author is professor of mechanics at the Hannover Institute of Technology and his book is based on a course of lectures given by him at the Institute. The volume before us is the first, theoretical part of the course; the second volume, which will treat of practical applications, has not yet been published.

The material is presented under the following main headings: hydrostatics; theory of uni-dimensional flow; general theory of the motion of ideal fluids; the theory of potential motion, vortices and von Karman's theory of fluid resistance; and general theory of the motion of viscous fluids, which takes up Prandtl's theory of the boundary layer.

The book is more practical than this enumeration of its contents may lead one to believe. True, the subject matter is developed along rigorous theoretical lines, yet the author is not unduly carried away by pure theory and hardly ever loses sight of the practical problems of hydraulics and aerodynamics. The author generally starts out with a statement of fundamental theory and immediately drives for its applied practical bearing. Thus after deriving the Bernoulli equation the author proceeds directly to a discussion of piezometers, the Venturi tube, flow from a small orifice, etc. Many apt illustrations and examples maintain the contact between theory and practice. The presentation is mathematical, but it is simplified, and elucidated so as not to require special training in higher mathematics and mechanics.

The book is unique in its scope and very commendable in its construction. Its translation into English is deemed very desirable.

Conquest of the Great Plains

THE GREAT PLAINS—By Walter Prescott Webb, Associate Professor of History, University of Texas. Boston: Ginn & Co. Cloth; 6x9 in.; pp. 515; many illustrations. $4.

THE conquest of the Great Plains, a vast treeless and semi-arid region, by a people brought up in a timbered and freely watered country is the topic of Prof. Webb's book—a volume as interesting to a wide range of readers as it is monumental in the field of social and environmental research. Besides the unknown and cruel forces of nature with which the conquerers of the Great Plains had to deal were the equally cruel Indians, far more alert, adroit and savage than the Indians of the East. With all the rest, the governmental institutions of the East had to be bent, broken and reshaped to meet the utterly different conditions of the Great Plains, in the face of the lack of knowledge and opposition of Eastern congressmen and administrative officials.

Two inventions are outstanding in the conquest of the Great Plains: the Colt revolver, which in the earlier days of its use gave the white man six shots with powder and ball to the Indian's one with bow and arrow, and barbed wire, which made fencing physically and economically possible in a treeless, stoneless country, made agriculture possible on what had been the open cattle range, and, what was even more urgent, made cattle ranching as contrasted with cattle ranging feasible. These, the railway, the windmill for lifting water, irrigation from streams and reservoirs and well-known improvements in farm machinery, are all given careful attention by Prof. Webb, as also the long and still unfinished struggle to adapt Eastern land and water laws to Western conditions.

Special mention should be made of the valuable chapters on "The Physical Basis of the Great Plains Environment," including structure, climate, plant and animal life; "The Plains Indians," how they got their horsemanship, weapons and particularly their sign language and its adoption and modification by our army and signal services; a chapter each on the American and Spanish approaches to the Great Plains, in the latter of which is brought out how the Great Plains blocked the expansion of slavery and Southern political power; and a most interesting review of "The Cattle Kingdom." Other topics dealt with are the literature and mysteries of the Great Plains, and the effect of that region on American life, character and institutions.

The volume contains 36 well-drawn maps and diagrams, showing among other things rainfall, wind velocities, railroads in 1890, areas of the United States subject to riparian, prior appropriation and mixed water rights laws, distribution of buffalo and jackrabbits. Among the seventeen halftones and drawings are portraits of Major John Wesley Powell, the "Big Four" in the barbed wire litigation, and views of the evolution of the Colt revolver, barbed wire and the windmill.

It would be easy to expand these notes to columns of interesting matter, some of which would relate to the author's summaries of the classic reports of Major Powell on "The Lands of the Arid Region," Col. H. M. Chittenden's "Reservoir Sites in Wyoming and Colo-

rado," and the still earlier activities of Jefferson Davis, while secretary of war in the late 1850's, which included the importation of camels for transportation in the Southwest, a trans-plains railway survey and studies of the possibilities of sinking artesian wells. Enough has been said to indicate the wide-ranging scope and high character of the book, which should insure it a host of readers, including many engineers.

Swedish Book on Building Construction

REVIEWED BY ODD ALBERT
Structural Engineer, East Orange, N. J.,
Formerly Professor of Mathematics, West College, Sweden

HUSBYGGNADSKONST TEKNIK — Av Henrik Kreuger. Professor i Byggnadsteknik Vid Kungl. Terniska Hogskolan. Fil. D.R.L.I.V.A. IV, Byggnadskonst. Stockholm: Albert Bonniers Publishing Co. Cloth; 7x10 in.; pp. 769; 1,256 line cuts and halftones. 55 kronor.

PROF. KREUGER'S book is the fourth volume of a series on building construction now published in Sweden. It deals with insulation, acoustics, fireproofing, weather permeability and building details. The part dealing with insulation against both heat and cold is based on the experimental results obtained by the author. It describes very clearly how insulation values for heat and cold may be determined without complicated calculations. Several examples are given, as well as insulation constants to be used.

The use of different materials for insulation against sound is described. Experimental results for different types of walls and floors as obtained by the author are given, with explanations and comments.

It is interesting to note that a chapter is devoted to "aircrete"—lightweight concrete—which now seems to be a standard product in Sweden. The author finds that for insulation against cold an aircrete wall is better than a brick wall of the same thickness, and that aircrete can be considered a fireproof material. Several houses constructed with outside walls of only 8 to 10 in. of aircrete that have been built in Stockholm are described with pictures.

Another part of the book deals with elements and constructions of walls, columns, stairs, floors, roofs, etc., with reference to different materials in respect to strength, durability and insulation against heat, cold and sound. Excellent pictures show building details, often very much different from American types. The splicing of steel columns, the arrangements of reinforcement in concrete columns, beams and arches, etc., and several other details should be worth study by the American engineer.

Diagrams and tables give the costs of walls, floors, columns, etc., using different kinds of constructions and materials. Charts indicate the comparative costs of roof and floor framings for different spacings of girders and beams for various loadings and spans.

The chapter on roof trusses is very complete, showing excellent details of different kinds of trusses and members; of joints and splices. Of special interest are the steel and concrete arches that are given both with and without hinges and tie-rods. Most of the different European systems, some of them patented, are shown here.

The book differs from most handbooks in that commonly used constructions and methods are dealt with as well as uncommon and seldom used methods. Many times only suggestions are made to solve a problem. Thus the book invites the reader to try new methods of design and construction.

Rainfall Cycles Historically Deduced

RAINFALL AND STREAM RUNOFF IN SOUTHERN CALIFORNIA SINCE 1769—By H. B. Lynch, Consulting Engineer. Los Angeles: The Metropolitan Water District of Southern California. Paper; 9x11 in.; pp. 31; tables and line cuts. Free until copies are exhausted.

BY SEARCHING records of the Spanish or Mexican missions and various diaries Mr. Lynch has been able to go far back of the rainfall records that were begun in a scattering way about 1850 and have been kept in more orderly and extensive fashion since the establishment of the U. S. Signal Service and its successor, the Weather Bureau. The 162 years of rainfall and runoff in southern California have been pictured and valuable conclusions drawn (as commented on editorially, *ENR*, Sept. 3, 1931, p. 358). Mr. Lynch's leading conclusion is: "There has been no material change in the mean climatic conditions of southern California in the past 162 years." But there have been many striking periodic fluctuations, at both extremes of rainfall, some of long duration. To any who question the value of conclusions drawn from the early records, we commend the following quotation from a foreword to the pamphlet, written by F. E. Weymouth, chief engineer of the Metropolitan Water District of Southern California:

> To men living almost, or perhaps wholly, without a roof; without proper clothing or protection; without roads or bridges; with only the food they themselves raise, and with no means of bringing in more if that fails; with no water supply other than as nature brings it, weather takes on an importance difficult for present-day city dwellers to picture. It is not surprising then in view of these considerations that weather conditions are recorded so minutely and vividly in the early diaries and letters.

Psychology and Patents

THE PSYCHOLOGY OF THE INVENTOR: A Study of the Patentee—By Joseph Rossman, Ph.D., M.P.L., B.S. in Chem. Eng., LL.B., Patent Examiner, U. S. Patent Office, Member of the Bar of the U. S. Court of Customs and Patent Appeals and the U. S. Supreme Court. Washington, D. C.: The Inventors Publishing Co. Cloth; 6x9 in.; pp. 252; tables. $3.

PATENT LAW FOR CHEMISTS, ENGINEERS AND EXECUTIVES—By Fred H. Rhodes, Professor of Industrial Chemistry, Cornell University. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x8 in.; pp. 207; $2.50.

BASED on the "views of 710 foremost living and most prominent inventors" and the author's long experience and observation in the United States Patent Office and as a member of the bar of the court of customs and patent appeals and of the federal supreme court, Dr. Rossman has written a unique book on "The Psychology of the Inventor." Among the famous men featured are Edison, Ford, Spencer Miller, Wilbur Wright and Charles C. Worthington. Besides the inventors questioned the views of 500 patent solicitors were sought. After a preliminary consideration of invention in general the author takes up such topics as classes and characteristics of inventors; methods, mental processes, motives, obstacles and pitfalls of inventors; psychological theories of invention, and the training of inventors. A bibliography and an index of names and of subjects complete the book.

Mr. Rhodes' "Patent Law" presents in brief compass the main facts on the subject likely to be needed by chemists, engineers and executives. Among the many chapters note may be made of those on "Invention and Discovery," "Utility and Novelty," "Infringement Suit" and "Rights of Employers and Employees." Like all well-prepared books of this general type, this one has citation and subject indexes.

Unique Honor to an Author

TECHNICAL WRITING—By T. A. Rickard, A.R.S.M., D.Sc. Formerly Editor of *Engineering and Mining Journal, The Mining Magazine*, and *Mining and Scientific Press*. Third Edition. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 5x8 in.; pp. 337. $2.

A UNIQUE honor to an author has been bestowed on Dr. Rickard by the decision of the American Institute of Mining and Metallurgical Engineers to give copies of his valuable book on "Technical Writing" to its "younger members." The publishers having decided to reset the type, Dr. Rickard seized the opportunity "to make sundry small corrections." The first two editions were favorably noticed in these columns May 20, 1920, p. 1027, and Dec. 20, 1923, p. 1028. In the preface to the present reprinting Dr. Rickard says: "To the younger members of my own profession of mining engineering, I can say more positively and more confidently as I grow old that the ability to express oneself clearly and pleasantly, in writing or in speech, is an accomplishment that gives keen pleasure in itself and is of unquestioned value to any man that desires to be effective in his day and generation." This sentence applies with equal propriety to members of the other branches of the engineering profession, whether young or old.

Peace and Contentment

HOW TO SPEND YOUR MONEY—By Ernest McCullough. New York: Jonathan Cape & Harrison Smith. Cloth; 6x8 in.; pp. 183; tables and diagrams. $2.50.

BASED on the fact that many people object to being told how to save money, Ernest McCullough has chosen "How to Spend Your Money" as a title for his latest book. As here treated spending includes systematic saving, safe investment and from time to time reinvestment, all to the end that financial peace and contentment may be insured. The opening discussion, on "Spending Money to Enjoy Life," is followed by a chapter on "Life and the Business Cycle," which every young person might well read and take to heart—and many older ones, too, before it is too late. After a chapter on "The Gross and The Living Income" comes a discusion of investments, beginning with investing rent money in homes and ending with stock market warnings. The book closes with "A General Discussion of Thrift." Written by an engineer, the book should appeal to that class, although addressed to all who, having money to spend, must save and invest wisely if they would avoid the financial crisis that may come at any time in their careers, particularly from 40 to 50 years onward.

Publications Received

ANALYTICAL MECHANICS for Students of Physics and Engineering—By H. M. Dadourian, M.A., Ph.D., Seabury Professor of Mathematics, Trinity College. Third Edition—Revised. New York: D. Van Nostrand Co. Cloth; 6x9 in.; pp. 427; 148 line cuts. $4.

The two earlier editions were reviewed in these columns by L. E. Moore and C. T. Morris, respectively, May 15, 1913, and March, 16, 1916. In the present edition "many pages have been rewritten" to make room for new material and to improve the method of presentation; notably Chap. V, "Equilibrium of Flexible Cords," has been "almost entirely revised."

ANTEIL DER KONSTRUKTION und des Materials an dem wirtschaftlichen Ausbau niedere Wasserkraft-Gefälle mit besonderer Berücksichtigung der Verhältnisse an der Ruhr—Von Dr.-Ing. Oskar Spetzler. Berlin: Julius Springer. Paper; 6x9 in.; pp. 94; line cuts and tables. 5.4 marks.

DER BAU DER NORDSCHLEUSENANLAGE IN BREMERHAVEN, 1928-1931: Herausgegeben unter Mitwirkung an dem Bau beteiligter Fachleute-Von Hafenbaudirektor Dr.-Ing. Arnold Agatz, Bremerhaven. Berlin: Wilhelm Ernst & Sohn. Paper; 10x14 in.; pp. 132; halftones, line cuts and tables. 6 marks.

BILLBOARDS AND AESTHETIC LEGISLATION: New Applications of the Police Power—By Lucius H. Cannon, Librarian, Municipal Reference Library, with an Introduction by Harland Bartholomew, Engineer, City Plan Commission, St. Louis, St. Louis, Mo.: The Municipal Reference Library. Paper; 7x10 in.; pp. 249.

DEN BRAND-SKADADE LAGERBYGGNADEN HERKULESGATAN 11, STOCKHOLM—By Ragnar Schlyter. Stockholm: Svenska Brandskyddsföreningens Förlag. Paper; 6x9 in.; pp. 78.

Report for the Swedish Concrete Institute on an investigation of the destruction by fire of a large concrete warehouse in Stockholm, June 25-26, 1929. The author is connected with the Government Testing Institute, at Stockholm. There is a 4-p. summary, in English, indicating that "the concrete structure satisfied very exacting claims in regard to construction" but drawing a number of lessons as to various details of design.

CAMP SANITATION—New York State Department of Health, Albany, N. Y. Paper; 6x9 in.; pp. 71.

CENTRAL ELECTRIC STATIONS IN CANADA (Census of Industry, 1929)—Prepared in collaboration with the Dominion Water Power and Hydrometric Bureau, Department of the Interior, with the assistance of the Ontario Hydro-Electric Power Commission, the Quebec Streams Commission, the New Brunswick Electric Power Commission, the Nova Scotia Power Commission and the Manitoba Power Commission. Ottawa, Ont.: Dominion Bureau of Statistics. Paper; 7x10 in.; pp. 64. 25c.

Statistical tables summarizing by provinces various physical and financial data of electric power plants, accompanied by text discussion.

CONCENTRATION OF CONTROL IN AMERICAN INDUSTRY—By Harry W. Laidler, Ph.D., Executive Director, League for Industrial Democracy; President (1930-32), National Bureau of Economic Research; Author, "History of Socialist Thought," etc. New York: Thomas Y. Crowell Co. Cloth; 6x9 in.; pp. 501; tables. $3.75.

EXPERIMENTAL STUDIES OF NATURAL PURIFICATION IN POLLUTED WATERS: IV. The Influence of the Plankton on the Biochemical Oxidation of Organic Matter—By C. T. Butterfield, Bacteriologist, W. C. Purdy, Plankton Expert, and E. J. Theriault, Chemist, United States Public Health Service. Reprint 1451, Public Health Reports. Paper; 6x9 in.; pp. 34; line cuts and tables. 10c. from Superintendent of Documents, Washington, D. C.

FARM TERRACING—By C. E. Ramsel, Senior Drainage Engineer, Bureau of Agricultural Engineering. Farmers' Bulletin No. 1669. U. S. Department of Agriculture. Paper; 6x9 in.; pp. 22. 5c. from Superintendent of Documents, Washington, D. C.

DIE GELENKMETHODE: Ein Verfahren zur Ermittlung statisch unbestimmter Grössen und deren Einflusslinien—Von Dr. sc. techn. Sayed Abd El-Wahed, Ingenieur der ägyptischen Staatseisenbahnen. Berlin: Julius Springer. Paper; 7x10 in.; pp. 45; halftones and line cuts. 4.5 marks.

AN INVESTIGATION OF PRESSURES AND VACUA PRODUCED ON STRUCTURES BY WIND—By Harold Mactavish Sylvester, Lieut. (J.G.) (C.E.C.), U.S.N. Troy, N. Y.: Rensselaer Polytechnic Institute. Paper; 6x9 in.; pp. 53.

A master's thesis based on airship hangar and other studies.

LIFE CHARACTERISTICS OF PHYSICAL PROPERTY—By Robley Winfrey, Bulletin Editor, Iowa Engineering Experiment Station, Edwin B. Kurtz, Professor and Head Electrical Engineering Department, State University of Iowa. Bulletin 103, Iowa Engineering Experiment Station, Ames, Iowa.: Paper; 6x9 in.; pp. 143; tables and line cuts.

DIE METHODE DER PRIMHAREN MOMENTE Zur Berechnung Ebener, Statisch Unbestimmter Systeme: Eine Analytische Festpunktmethode—Von Axel Efsen, Ingenieur, M.Ing.F. Kopenhagen: In Kommission Bei G.E.C.Gad. Paper; 7x10 in.; pp. 142; diagrams.

PLASTICITY: A Mechanics of the Plastic State of Matter—By A. Nádai, Dr. Eng., M.Am.Soc.M.E., Research Laboratories Westinghouse Electric & Manufacturing Co.: Member Faculty of Graduate School, University of Pittsburgh; formerly Professor of Applied Mechanics at the University of Göttingen, Germany. Assisted by A. M. Wahl, M.S., M.Am.Soc.M.E., Research Laboratories of the Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa., New York and London: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. 349; many illustrations. $2.50.

PHYSICAL PROPERTIES OF EARTHS—By John H. Griffith, Professor of Civil Engineering—An Investigation Conducted at Ames, Iowa, by the Iowa Engineering Experiment Station in Cooperation with the Bureau of Public Roads. Ames, Iowa. As above. Paper; 6x9 in.; pp. 128; tables and illustrations.

Belated publication of work done some years ago, which, the author believes "has not lost its value." Takes up tensile and compressive strengths, shear, displacement, flow of water through earth, electrical resistance, colloidal and supplementary data and ceramic properties.

PROSPERITY PROBLEMS: Why, Whence, Whither? and With What Part in World Welfare?—By Arnold G. Dana, from 1887 to 1922 on Statistical-Editorial Staff of *Commercial and Financial Chronicle*. New Haven, Conn.: Tuttle, Morehouse & Taylor Co. Cloth; 6x9 in.; pp. 451; tables. $3.50.

RAILROAD CURVES AND EARTHWORK—By C. Frank Allen, S.B., M.Am.Soc.C.E., Professor of Railroad Engineering in the Massachusetts Institute of Technology. 7th edition, revised. New York and London: McGraw-Hill Book Co. Cloth; 5x7 in.; pp. 290; tables and illustrations. $4.

In this edition there appears for the first time a chapter on "String Lining of Curves," with a cancel table original with the author and "believed to be new." The chapter on "Turnouts" has been revised, with acknowledgments to Prof. J. B. Babcock.

SAFETY CODE FOR ELEVATORS, DUMBWAITERS AND ESCALATORS: Rules for Construction, Inspection, Mainte-

nance and Operation. Second Revision. New York: American Standards Association, 29 West 39th St. Paper; 5x8 in.; pp. 173. $1.

WIND-PRESSURE ON BUILDINGS: Experimental Researches (First Series)—By J. O. V. Irminger and Chr. Nokkentved. Members Denmark Institution of Civil Engineers. Translated from the Danish by Alexander C. Jarvis and R. Halfdan-Nielsen, Members Denmark Inst.C.E. Copenhagen: Danmarks Naturvidenskabelige Samfund, G.E.C.Gad. Paper; 7x10 in.; pp. 88; many illustrations. 10 kronen.

WIRTSCHAFTLICHE STÜTZUNG VON TRAGGEBILDEN: Zeichnerische und rechnerische Verfahren zum wirtschaftlichen Vorentwerfen von Bauwerken (Decken, Dächer, Hallen, Brücken usw.) unter Berücksichtigung der von seiten der Praxis gegebenen Bedingungen und Wünsche—Von Dr. Ing. Robert Schönhöfer, Ordentl. Professor an der Technischen Hochschule in Braunschweig. Leipzig: Universitätsverlag von Robert Noske. Paper; 7x10 in.; pp. 185; line cuts. 15 marks.

LETTERS TO THE EDITOR

The Vierendeel Truss

Sir—It is gratifying to find that Dana Young (*ENR*, Aug. 13, 1931) has called to attention a truss without diagonals commonly known as Vierendeel truss. There is vast esthetic possibility in the design of the reinforced-concrete Vierendeel truss as illustrated by Prof. George A. Hool ("Reinforced-Concrete Construction," Vol. III, 1916, pp. 646-647).

A number of approximate methods for the determination of stresses in the Vierendeel truss have been developed. Mr. Heim (*Beton u. Eisen*, 1922, Heft 15-17) has described a successful experimental test of the reinforced-concrete model of the Vierendeel truss one-tenth of the actual size designed by Prof. Saliger's approximate method.

The main objection usually made to the Vierendeel truss of long span is the high shear stresses. However, this difficulty has often been avoided by using solid walls in the end panels and suitable haunches at the verticals.

In the reinforced-concrete truss with diagonals, high unit stresses are produced due to the setting properties of concrete.

A. A. EREMIN,
Assistant Design Engineer, Bridge Department, State Highway Commission.

Sacramento, Calif., Aug. 27, 1931.

Work for All

Sir—I want to congratulate you upon your editorial in your issue of Sept. 3, "Work for All." I believe that you outline the most logical and sensible way of handling the unemployment problem that is confronting us at this time. Ninety per cent of the unemployed would rather work for reasonable wages than receive charity. I believe the same percentage of the taxpayers would sooner pay a tax to take care of several billion dollars worth of bond issue than to be continuously panhandled by some solicitor of charity.

There is one other matter that I would like to bring out: All the public improvements and public work such as river improvement, highways and public building should be let by contract to the lowest and best bidder without any government interference or dictation as to what the contractor should pay for his labor and materials.

In Illinois they have 7½ million dollars tied up in road funds at the present time due to the interference of the state authorities. Where in the northern part of Illinois they want 55c. per hour for labor, in the southern part of the state thousands of men are willing to work for 25c. per hour.

I have also noticed in one of your issues the published scale of wages of the Sanitary District of Chicago, which I think is ridiculous under the present conditions. Bricklayers are still asking $1.50 per hour, hoisting engineers and common laborers 90c. to $1.25 per hour. Taking the bricklayer's wages at $1.50 per hour (he works eight hours per day), the Kansas or Dakota farmer would have to pay this man in wheat at 25c. per bushel 48 bushels per day. Supposing this man works 300 days per year, which the farmer has to do every year; that farmer would have to pay Mr. Bricklayer 14,400 bushels of wheat for one year's work, which is entirely out of reason. As long as these great differences exist our country will not prosper. The same comparison will apply between the high-priced city employee and the cotton farmer in the Middle and Southern states.

I hope that these things will adjust themselves and we will once more have normal conditions.

FRED SCHELBEN,
Mayor.

Greenville, Miss., Sept. 10, 1931.

Public Work by Private Engineers

Sir—While it appears that the national government's policy will be to place relief work in the hands of the "charitable" organizations during the coming winter, it may be possible that real constructive work may be attempted. Should such be the case, only one way presents itself to me in order to carry out the work with sufficient despatch and in large enough volume. The way is to turn over projects to private engineers or architects, giving them full power to act—that is, to design, to let contracts and to supervise construction. By this method a tremendous volume of work could be handled and if proper men were selected the work would be efficiently handled.

These suggestions apply to city, county and state work as well. The city and county engineering departments have in the past taken on large amount of work more properly belonging to the private engineer. If construction activity is to be the Moses to lead us out of the present, as set forth on the cover of your issue of July 30, this method offers one real possibility of carrying out work in sufficient magnitude to affect results.

JOHN E. CONZELMAN,
Consulting Engineer.

Los Angeles, Calif., Aug. 25, 1931.

Relief by Public Works

Sir—The editorial "Work for All" in the Sept. 3 issue of *Engineering News-Record* should be brought to the attention of every Senator and Representative at the very earliest date. I am of the opinion that the plan you outline is one of only two methods of approaching this problem of depression. The other, a much less desirable method, would be to restrict the working hours of all persons and industries to a point where everybody would have a few hours' work a day. The plan you outline is constructive and is much to be desired over the plan of limitation. And even though it involves an increase in taxation, I believe every thinking man should be willing to assume this increased burden of taxation if business can be brought back to anywhere near the operating basis of the years of 1927, 1928 and 1929.

W. C. FERGUSON,
President, Presstite Engineering Co.

St. Louis, Mo., Sept. 3, 1931.

Four Methods Possible

Sir—We are very much impressed by your editorial "Work for All" in the Sept. 3 issue.

The country is going to keep the unemployed from starving to death and freezing to death. The real question is how this is to be done. We can go right on as we're going: herd these men in municipal lodging houses, in missions, in institutions of all kinds. A large number will become professional tramps and mendicants, another large number will become petty criminals.

A better method would be to give these men a dole. They can then maintain some kind of home life. They would not be herded like cattle. They will not lose their identity, their individuality. Nevertheless they will be degraded. Anyone who eats without working is degraded whether he be a "bum" or a millionaire.

A far better scheme would be to organize partly self-supporting communities where only a minimum of charity would be required. Let the unemployed cooks do the cooking, the unemployed cobblers keep the men's shoes in con-

dition, the tailors the clothes, the carpenters and mechanics provide them with shelter and heat, all without cost to the public at large, except for the superintendence and the raw materials. In some respects this is better than the dole, but it falls far short of the ideal.

Certainly the most practicable and the simplest method of meeting the problem is the one suggested in your editorial. The officials at Washington were not put there to accumulate surpluses; they were put there to serve the people. The borrowing power of the government is enormous. Its credit is the best in the world. Billions of dollars' worth of public works can be carried out. When the work gets fairly under way the depression will be over. DUDLEY P. BABCOCK.

New York City. Babcock Bros., Consulting Engineers.
Sept. 4, 1931.

Financing Unemployment Relief

Sir—Your editorial in the Aug. 27 issue advocating governmental action to relieve the unemployment situation is right to the point. It should be followed up in a national campaign. The Nacasa Syndicate has been organized for that purpose, but our plans had to do with Latin American countries. There is no reason, however, why the Nacasa Syndicate plan should not work equally well for this country. Briefly the plan is as follows:

After a thorough economic survey as to the needs of the country, the central government shall allot to each state a sum to be spent on public improvements of productive character. These would include waterpower development, roadbuilding, construction of docks and harbors, reclamation, etc. The states would issue interest-bearing bonds payable only to the central government for the cost of the improvement allotted to them. Amortization would be provided as usual. The central government would issue a similar amount of bonds, these bonds to remain in the national treasury, not for sale. At the same time the central government would issue component bond notes in denominations of $1, $2, $5, $10, $20, $50, etc., to equal the amount of bonds issued by the states. The component bond notes should be made legal tender and paid to the states in exchange for their bonds. They would be deposited in the state depositories and checked out for the payment of accounts on the improvement program as are other funds. The central government bonds would remain in the treasury bearing no interest until such time as component bond notes should be presented for redemption. Then a bond to a corresponding amount should be issued and the component bond notes surrendered would be destroyed.

If this plan is adopted it will immediately relieve the unemployment situation. Every idle man in the country can be put to work. There will be no need of a vast national charity organization soliciting funds to keep the out-of-work citizens in semi-starvation over the winter and to pauperize them. For my part I would rather accept a dole than the charity of these local unemployment relief associations. I assisted in one of the unemployment offices last winter and I know how it functioned.

This plan which I submit has been discussed with the leading bankers of this and other big centers. Economists of undoubted ability have gone over it. Without a single exception they have pronounced it absolutely sound as an economic proposition, but the banks do not want it. These bankers all admit they have nothing to offer for the relief of the world, but a plan which does not contemplate their personal and immediate relief from the overdose of foreign government bonds with which they are suffering cannot command their interest or assistance. They are sure that if we let things ride for several years the present difficulties will work themselves out.

One thing we may be sure of. Unless the plan here submitted is undertaken many states in this country cannot take care of their unemployment situation this winter. This winter is not going to be the last one. There will be unemployment the winter of 1932-33, perhaps as much as or more than there is this year. We should not deceive ourselves by thinking that a few millions of dollars of charity given this coming winter is going to set the wheels of industry in motion and bring back prosperity. Charity never made any people prosperous. What we want is for every city, every county, every state in the country to put their people at work.

When the Union Pacific Railroad was pushed across the wilderness to our western coast in the '60s, it was built by government credit—the credit of a government which was six billions of dollars in debt for a civil war that had bankrupted our treasury. We had no credit in the outside world, no foreign commerce, no industry. We began to develop our own resources in the face of opposition which said the country would be ruined by the building of that railroad. Internal development produced for us the empire of our great West and made us the most powerful nation in the world. Today, with unlimited credit, unparalleled industrial development and millions of idle hands waiting to go to work, can we not again begin the development of our own resources and bring back prosperity to a people who are waiting for a chance to go to work, not to drag their weary feet down to city hall to get three days' work a week on a charity payroll? FREDERICK L. LONG.

New York, N. Y. Nacasa Syndicate.
Sept. 10, 1931.

Engineers Fall Short of the Ideal

Sir—Many of your engineer readers will no doubt agree with your editorial entitled "Too Many Graduates?" appearing in the issue of your paper of July 30. Such agreement, however, is more likely to be based on a feeling of satisfaction that an authority is complimenting or paying recognition to the profession, rather than on a strictly scientific analysis of the facts underlying the assertions or statements.

Many other practicing engineers, particularly those who have been called on by our various legislative assemblies to act as administrators of registration acts, will view the conclusions arrived at in an entirely different manner and will in no way agree with the views of your writer.

As a result of the influence of the registration acts, these engineers are studying the causes of the bad conditions within the profession and are paying that attention to the details of engineering curricula which, to the reproach of the engineering profession be it said, did not occur in the past. As a result of these studies such engineering administrators would use J. L. Harrington's definition of what an engineer should be as a standard, and they would check all engineering curricula by the standard of curricula connoted by Mr. Harrington's definition, which reads:

> The [engineer] of the highest order is not only a cultured gentleman, versed in all the amenities of polite society, familiar with the best literature in his own language and probably in that of one or two others, able to read many branches of learning understandingly and to discuss them intelligently; but, in addition, he has special knowledge of mathematics and the applied sciences, and he is able not only to understand what is written or spoken about them but also to express his own thought readily, accurately and logically.

After study of our curricula it can be stated with little fear of successful contradiction that our engineering education does not make our graduates familiar with the best literature in our own language; nor does it make them familiar with the literature of even one other language; nor does it make them "able to read many branches of learning understandingly, or discuss them intelligently."

If the practicing engineers do succeed in taking a deep, continued and sustained interest in engineering education; if they do succeed in having their representations recognized by the educational authorities; if after a number of years they do succeed in making the engineers' curricula approach the standard connoted by Mr. Harrington's definition, even then the modest engineer would hesitate to recommend to our growing youth that the engineer's education is more suitable for a life of affairs, for a life of commerce, than the arts curriculum or the curriculum as laid down by some of our chairs of commerce.

As to the more practical or professional aspects of the problem, the practicing engineer, influenced and taught by his administration of a registration act, recognizes from

your article that there can be but little professional tradition or knowledge of the profession's real needs inculcated in such a university as contemplated by your writer, when the avowed intention of its engineering school is to train not only engineers but men of commerce; not only consulting engineers but stockbrokers and bond dealers. These practicing engineers can only view with regret such statements as these when sponsored by your paper, bearing in mind that these stockbrokers, these bond dealers, after merely four or five years in an atmosphere which cannot be truly professional, yet carry professional degrees throughout the length of their lives, such as C.E., M.E., E.E. or B.A.Sc.

E. A. WHEATLEY,
Registrar, The Engineering Profession in British Columbia.
Vancouver, B. C.,
Sept. 5, 1931.

Too Many Graduates?

Sir—Reference is made to your editorial entitled, "Too Many Graduates?" in the July 30 issue of *Engineering News-Record,* wherein you recommend that a broader view be taken of the function of engineering education and declare it to be excellent preparation for other lines of activity. You conclude with the statement, "There cannot be too many graduates turned out by our engineering schools." The writer is, to a certain extent, in agreement with this conclusion, but feels that it needs qualifications before it can generally be accepted.

During the two years from 1929 to 1931 it was my pleasure to serve as president of the California state board of registration for civil engineers. In this period the board received more than 5,700 applications for registration under the "grandfather clause" of the California act, each application being accompanied by a detailed professional biography.

I had opportunity to review all these biographies and about 60 per cent in minute detail; to interview in person more than a thousand applicants; and also to correspond with a large number of them. This experience afforded contact with a very good cross-section of the civil engineering profession, not alone in California but in the entire country, as many of the applicants had come to California only in recent years. As a result, I acquired some rather definite convictions in regard to engineering education and to the engineering profession as a whole.

There is in California approximately one registered civil engineer per thousand population. One reason for overcrowding in the engineering profession and excessive competition therein is that incompetency cannot be immediately detected as it can in law, medicine and other professions. A poor lawyer is defeated in court, and his lack of ability is soon detected. A poor doctor loses his patients to the undertaker. An incompetent architect has the monuments of his inefficiency maintained before the eyes of the world: whereas incompetent engineering work is usually not detected for many years and may only show up in the failure of a structure under extreme conditions, in excessive operating or maintenance costs, or in premature obsolescence. Thus men in the engineering profession, who are incompetent or temperamentally or otherwise unfit, may remain there for a long time and continue to advance. Another reason for the apparent overcrowding of the profession is the fact that everyone enrolling in an engineering course is made to feel that he must continue in the engineering profession, even though he doesn't complete his course and graduate.

Would it not be better, even with our present four-year courses, to segregate the first two years and treat them as pre-engineering courses? Then the student failing to complete his course would not of necessity feel the urge to continue in engineering but might appreciate the fact that the training during this period would fit him for other lines as well.

Would it not be well for engineering instructors to instill in the minds of freshman students the fact that they are entering a course of instruction that will fit them to follow a career, not alone in engineering but in any line that requires analytical training and a quantitative approach to the problems to be encountered?

Would it not also be well if engineering graduates from the present four-year courses were given a picture of what lies before them if they follow a career in engineering and likewise had impressed upon them that their training forms an excellent groundwork for a career in other lines?

The writer fully appreciates the value of the training received in an engineering course, not alone for a career in engineering but for one in other lines, and feels that while there may be too many men in the engineering profession there is an insufficient number of men with engineering training in other fields.

You refer in your editorial to the limited opportunities afforded in the field of engineering. Are students advised of this fact when they embark upon an engineering course? Are they told that engineering, unlike medicine, law, architecture or dentistry, is a profession composed primarily of subordinates, each acting as a cog in a machine with more or less routine or specialized duties? Do these students know that the profession of engineering—if it can really be termed such—is organized like that of banking, requiring a large proportion of its members for routine technical work and holding its highest awards for executive or administrative ability and only a general knowledge of technical fundamentals? Are the existing engineering courses designed in the light of this fact?

One is inclined to question whether engineering education is not unduly dominated by engineering educators, and whether employers of engineers in industry, as well as practicing engineers, should not be given a greater opportunity to outline courses, subject matter and methods of instruction. Also whether our engineering courses as now designed meet existing economic conditions or conditions that will exist in the next ten or fifteen years when present students begin to exercise responsibility and engineering judgment.

The pioneering stage in this country has passed. Economic and social conditions are becoming more stabilized, and it is felt that we shall soon have to adopt the European system of longer methods of training for those who hope to obtain the top ranks in the profession.

Do we not need a revamping and a lengthening of time spent in engineering education to afford a broader and better training for the few who are to fill the higher positions in the field, and a lesser training for the many who must always constitute the rank and file? Would not such a lengthened course assist in weeding out the many who can never hope to pass out of the subordinate class? A six-year course composed of three years of pre-engineering followed by three years of a technical course, with a proper separation of the two, might help the situation.

If the above suggestions could be accepted by engineering educators and be given to and impressed upon engineering students, the writer feels that he would be in complete agreement with the statement quoted in your editorial.

DONALD M. BAKER,
Consulting Engineer.
Los Angeles, Calif.,
Aug. 31, 1931.

Low Production and Unit Costs

Sir—Your issue of Aug. 13, 1931, p. 261, contains a quotation from *The Steel Founder* under the heading "Low Production and Unit Overhead Costs." There is a fallacy in this statement which should be noted, that is, in times such as these it is necessary that selling prices be reduced even though temporarily production is at a much lower level. Therefore, as a matter of record, it is satisfactory to increase the cost per unit due to the increased ratio of overhead to production, but when it comes to a matter of selling or in quoting for new business one must use the normal ratio of overhead to normal production, as otherwise one would never be able to get any business to get one's shop up to normal production.

In case the production does not come up to normal, the difference in stand-by overhead must be absorbed in profit and loss, as otherwise prices would be increased to such an extent that there would be no production whatsoever and all the stand-by charges would have to be absorbed in profit and loss.

C. M. MCKINLEY,
A C Spark Plug Co
Flint, Mich.,
Aug. 19, 1931.

NEWS OF THE WEEK

Pennsylvania Bars Minnesota Construction Materials

Pennsylvania has used its statute of reciprocal limitations in barring the purchase for any public works of materials, equipment or supplies manufactured in Minnesota. This action is in retaliation for the prohibition contained in a Minnesota statute requiring that only local products be used in the foundations, steps, approaches and outer walls of public works in Minnesota. The Pennsylvania law becomes effective as to the products of another state whenever that state prohibits the use or purchase of non-domestic supplies for its public works, irrespective of the degree or extent of the prohibition in that state. The Pennsylvania state department of justice is of the opinion that Minnesota is discriminating against other states, including Pennsylvania, and that therefore the Pennsylvania act becomes effective.

Bids Opened for New York's New Union Inland Freight Terminal

Bids were opened by the Port of New York Authority on Sept. 10 for the construction of the new union inland freight terminal, which will be erected on the block bounded by Eighth and Ninth Aves., Fifteenth and Sixteenth Sts. in New York.

Four bids were received, as follows: Turner Construction Co., $7,591,000; James Stewart & Co., Inc., $8,107,000; George A. Fuller Co., $8,194,000; John T. Brady & Co., $8,911,000. All the bidders are located in Manhattan.

The building, which will be sixteen stories high with two basements and will contain 38,000,000 cu.ft. of space, must be completed, under the contract, before Nov. 30, 1932. The foundation contract, which was awarded last spring to the Godwin Construction Co., will be completed about Oct. 1, and the contract for the superstructure will probably be awarded before that date.

Siam to Have American Adviser on Water Supply

Theodore W. Hacker, for fifteen years an associate engineer with Whitman, Requardt & Smith, of Baltimore, left Sept. 5 for Siam, where he will act as technical adviser to the Siamese government on water supply for the interior cities of the country. These have no modern supplies and water is procured from wells which are not adequately protected from a health standpoint. Mr. Hacker will be in Siam for a year or more. This is the first major health movement of such magnitude ever made in the country.

Public Belt Bridge Bids Are Opened in New Orleans

THE American Bridge Co. and the McClintic-Marshall Corp. submitted low bids for the construction of the superstructure of the proposed Public Belt Ry. 23,000-ft. combined highway and railroad structure over the Mississippi River near New Orleans, according to proposals opened in that city Sept. 15.

For the eight main spans, totaling 3,521 ft. in length, the American Bridge Co. was low, bidding 5.08c. on 39,400,000 lb. steel excluding eyebars, 6.3c. on 2,800,000 lb. eyebars, $71 on 550,000 ft.b.m. timber ties, etc., $22 on 3,270 cu.yd. concrete roadway, 3.4c. on 225,000 lb. roadway reinforcing steel and 21c. on 183,000 lin.ft. roadway reinforcing trusses.

The McClintic-Marshall Corp. was second low on the main span steel, bidding 5.99c. and 7.91c., respectively, on the first two items. McClintic-Marshall was low on the approach steelwork with a bid of 3.57c. for 78,000,000 lb. of metal. Siems-Helmers, Inc., St. Paul, was reported low bidder on the main river piers.

Bids Less Than Estimates

Gov. Huey P. Long, who presided at the opening, announced that the bid figures indicated the structure would cost less than $15,000,000, exclusive of interest charges during construction. Original estimates had placed the cost in excess of $19,000,000. The bridge will be financed by $7,000,000 contributed by the Louisiana state highway department, with the remainder of funds required to be furnished by the railroad companies using the crossing, principally the Southern Pacific Lines.

The main spans consist of a 790-ft. cantilever with two 530-ft. anchor arms; one simple through-truss span of 531.5 ft.; one deck-girder span of 330 ft. 4 in. and three of 270 ft. Two open-deck railroad tracks will occupy the space between trusses. An 18-ft. concrete roadway and a 2-ft. sidewalk will be carried on brackets outside the trusses on each side. The structure will have a clear height of 135 ft. above high water for 500 ft. Deck-girder approaches totaling nearly 20,000 ft. long, about equally divided on each side of the river, will be required for the railroad tracks. The highway approaches will be much shorter. Open wells reaching to a depth of 160 ft. below low water will be sunk for the main river piers.

Modjeski, Masters & Chase are consulting engineers on the project.

Collapse of Subway Steel Kills Two in Newark, N. J.

Two workmen were killed, three seriously injured and several others less severely hurt when about 60 steel subway bents toppled over in the construction of a rapid transit line in the bed of the old Morris Canal in Newark, N. J., Sept. 14. The steel bents, on 5-ft. centers, were temporarily set up awaiting pouring of concrete around their bases. They were held in place by longitudinal tie-rods and wooden spreaders. Reports are that the accident was caused by failure of a crane boom while setting one of the bents, the falling steel knocking over the adjacent bent, causing the whole row to collapse. The work is being done by the Newark department of public works, under the direction of James W. Costello, chief engineer, and Ralph Smillie, transit engineer. Carl Koch, Inc., is erecting the steel under a subcontract with the Thomas Crimmins Contracting Co.

Madden Dam Contract Awarded

Contract for the construction of Madden dam and appurtenent work in Panama was officially awarded Sept. 14 to the W. E. Callahan Construction Co., St. Louis, and Petersen, Shirley & Gunther, Omaha, who submitted a joint bid. Plans for the project, described in *ENR* July 30, 1931, p. 162, were prepared by the U. S. Bureau of Reclamation. Construction will be under the supervision of the Panama Canal. The contract price is $4,048,657.

New State Public Works Building for Massachusetts

Gov. Ely, of Massachusetts, has approved plans for the new state department of public works building, to be located at Nashua and Lowell Sts., Boston. The legislature has authorized $1,500,000 to cover the project. The building will be 366 ft. long by 90 ft. wide and eight stories high.

Railway Conventions Postponed

At the instance of organizations of railway executives, desiring to restrict expenses wherever possible in view of the serious financial situation, the American Railway Bridge and Building Association and the Roadmasters and Maintenance-of-Way Association have decided to cancel their 1931 annual conventions, which were to be held at Toronto, Canada, and Chicago, Ill., respectively. The former association will issue the reports already prepared, but the latter will refer the reports back to the committees for further consideration.

Depreciation Plan Is Set Up for Rail and Phone Companies

ALL railroads and telephone companies have been ordered to establish, effective Jan. 1, 1933, a complete system of depreciation accounting at percentage rates to be fixed by the Interstate Commerce Commission on the basis of the companies' experience. The telephone companies have been practicing depreciation accounting for many years under a requirement of the commission dating from 1913. The railroads have had depreciation accounting on equipment since 1907, but the commission left it optional as to other railroad property, and as regards both railroads and telephone companies the commission has not prescribed any rates heretofore. The telephone companies are in favor of depreciation accounting, but railroad and gas and electric companies always have opposed the plan.

The railroads have preferred and have used for property other than equipment a plan which is known as the retirement plan by which the cost of worn-out property is charged to expenses at the time of retirement so that its exact cost is known. Under the commission's plan the roads will be required to anticipate cost of retirement by charging to their expense account, monthly and annually, percentages for different classes of property representing estimated service life.

The railroads object to a method based on estimates rather than facts and to the introduction of such a system at a time when it leaves unprovided for billions of dollars' worth of what will become, under the commission's ruling, past accrued depreciation. As this has not been charged to operating expenses currently, it becomes an obligation against capital. While the roads have accrued nearly two billion dollars in the equipment depreciation reserve, the commission's bureau of valuation has estimated past accrued depreciation on all railroad property at nearly six billion dollars on the basis of 1930 prices, and at more than four billion on the basis of original cost, thus leaving two to four billion dollars that, exclusive of equipment depreciation reserve, is not provided for.

The commission maintains that depreciation must be based on original cost of the property, whereas the railroads contend that it should be based on cost of replacement. The commission has ordered the roads to use as an original cost estimate its valuation figures for cost of reproduction at 1914 prices except where the railroads can produce better estimates of actual original cost.

The commission's order is the result of ten years of investigation under Commissioner Joseph B. Eastman's direction following amendment of the law adopted by Congress in 1920 instructing the commission to prescribe the classes of property for which depreciation may properly be charged to operating expenses and to fix depreciation rates.

Jersey City to Vote on City Manager Form of Government

As the result of a petition filed in Jersey City on Sept. 14, bearing 24,833 signatures and asking for a city manager form of municipal government, an election will be held on Oct. 6 to decide if such form of government shall be adopted. The city is now governed by a city commission headed by a mayor.

W. H. Wattis, Dean of Western Contractors, Dies Sept. 13

William H. Wattis, president of the Utah Construction Co. and head of Six Companies, Inc., contractor for Hoover Dam, died in San Francisco

Wide World Photo

William H. Wattis

Sept. 13 after a long illness. He was born 73 years ago near Ogden, Utah, and spent his entire life in the West. Mr. Wattis was long connected with the Utah Construction Co., doing reclamation, hydro-electric, highway and railroad construction from Mexico to Canada and from the Rockies to the Pacific Coast. He was an active member of the Associated General Contractors, and was director of that organization for the past three years.

Progress on Owyhee Project

The Owyhee Dam is now more than 80 per cent complete, or to within 120 ft. of the top, having risen more than 410 ft. above lowest foundation. During the favorable fall weather a large amount of the remaining work will be accomplished, including installation of the ring gate at the spillway shaft. The General Construction Co. is employing about 270 men.

At Tunnel No. 1 inlet the T. E. Connolly Co. has excavated 6,200 ft. from the portal, while at Tunnel No. 1 outlet the J. F. Shea Co. is in 6,400 ft. The concrete lining of Tunnel No. 5 inlet end is being placed from the 2-mile point back toward the portal. Magoffin is using steel lining through the soft ground in Tunnel No. 5 outlet.

Forced Closing of Many Stream-Gaging Stations Is Predicted

BEFORE the effects of one of the greatest droughts in history have disappeared, work on determining the country's water resources will find itself sharply curtailed. After Oct. 1 the Geological Survey is to receive from the war department no more funds for the maintenance of 654 stream-gaging stations. These were established three years ago in connection with the program of stream surveys to be made by the Corps of Engineers at the direction of Congress.

Definite provision is made for maintenance of only 120 stations after the war department's support ceases. The status of the remainder depends upon state cooperation, and indications are that about 200 stations will have to be discontinued. Impressed by last year's drought with the importance of basic data on streamflow, many of the states have appropriated more liberally for this work. However, many of the gages that the Geological Survey desires to retain are located in public land states and so become a charge on the federal government. The extent to which the army engineer stations may be covered by the program of state cooperation also is rendered doubtful because of the divergence between state and federal interests. The former relate principally to evaluation and adjudication of water rights, including distribution of water among different users, while the federal government is primarily concerned with international and interstate problems of utilization, navigation and flood protection.

It was to care for the gages maintained on behalf of the Army Engineer Corps that the Geological Survey sought an apparent increase from $510,000 to $700,000 in its appropriation for the current fiscal year. The war department previously had been allotting about $250,000 a year for this purpose and the $190,000 was intended to carry the stations on during the nine-month period after war department allotments cease Oct. 1.

Anticipating some state cooperation, George Otis Smith, director of the Survey, proposed when this year's budget was under consideration a year ago that of the $700,000 total $175,000 should be provided for continuing the operation of army stations that otherwise would be abandoned. He recommended that $525,000 should be restricted to maintaining stations now operated in cooperation with the states.

This plan met resistance from Representative Cramton, chairman of the House subcommittee on interior department appropriations. In response to Mr. Cramton's contention that outright federal provision for all of the army stations might kill cooperation on the 50-50 basis in other states, Dr. Smith classified 534 stations as of a type now maintained in cooperation with states and

municipalities and 120 as having almost wholly a federal interest. The federal classification includes gages at or below the fall line of coastal rivers and stations within the navigable parts of the Mississippi and Columbia rivers and their tributaries. The result is that the $175,000 originally proposed by Dr. Smith for outright federal maintenance of army stations was trimmed to $45,000, while a fund of $552,000 was appropriated for meeting state cooperation. Concerning the fate of 534 stations, it seems certain, according to N. C. Grover, chief hydraulic engineer of the water resources branch, that an indefinitely large number of them must be abandoned because the states will be unwilling or unable to contribute money for their support.

Gen. Lytle Brown, Chief of Engineers, states that except for stations which the engineers have operated, the army is no longer interested in stream gaging, as its program of preliminary and project studies that have been ordered by Congress in 1927 is now practically complete.

Philadelphia Construction Industry Names Engineers

Frank Parker, director of the Philadelphia Federation of the Construction Industry, has announced the appointment of James W. Follin as engineer and A. B. Randall as research engineer.

Mr. Follin was formerly secretary and engineer of the Philadelphia Building Chapter, Associated Pennsylvania Constructors, and is president of the Philadelphia Section, American Society of Civil Engineers, and a director of the Engineers' Club. He has been staff engineer for the Bureau of Municipal Research in Philadelphia and assistant chief engineer of the Pennsylvania department of highways. In 1929 he conducted a survey of the administration and engineering work of the state highway commission of New Jersey for the State Audit and Finance Commission. Recently Mr. Follin has been associated with the Regional Planning Federation of the Philadelphia Tri-State District.

Mr. Randall is well known as a research engineer and for the past year has been engaged by the Philadelphia Building Congress on special studies of public construction and economic analyses of building projects and existing properties.

Last Covered Bridge on Ohio National Highway to Be Replaced

Announcement is made by O. W. Merrell, Ohio director of highways, that plans have been made to replace the last wooden covered bridge on the national highway in Ohio. The old bridge, over the Mad River, is 178 ft. long with two equal spans, and was constructed in 1839. It contains two roadways, each 14 ft. wide, separated by trusswork.

COSTS AND CONTRACTS

ENR Index Numbers

Cost			Volume		
Sept. 1,	1931	171.40	August,	1931	187
Aug. 1,	1931	171.38	July,	1931	248
Sept. 1	1930	199.58	August,	1930	259
Average,	1930	202.85	Average,	1930	260
Average,	1929	207.02	Average,	1929	317
1913	.....	100.00	1913	.....	100

This Week's Contracts

Heavy construction contracts, reported by *Engineering News-Record* in the week of Sept. 17, with some comparisons, total as follows:

(In Thousands of Dollars)

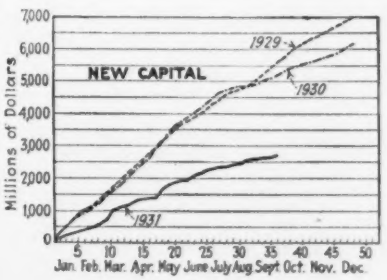
	Sept. 17, 1931	Average of Last Four Weeks 1931	1931
Buildings:			
Industrial	$2,595	$2,536	$4,600
Other	21,805	12,025	20,992
Streets and roads.	6,902	6,235	10,629
Other construction	11,302	19,761	16,651
Total	$46,604	$40,558	$52,873
Total, all classes, Jan. 1 to Sept. 17:			
1931			$1,926,808
1930			2,523,926

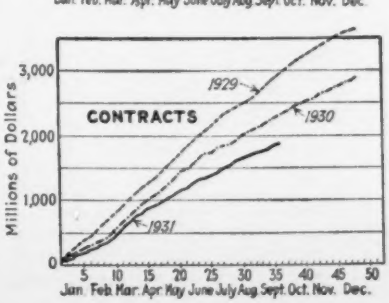
Capital and Contracts

New capital issued in the week of Sept. 12 totaled 10 millions, 8 millions of which were for public engineering projects. The weekly average thus far this month has been but 8 millions, compared with 56 millions in August and 84 millions in September, 1930.

The principal issues of the week consisted of the following: Scranton-Spring Brook Water Service Co. 5s, $1,650,000; Metropolitan Transit District of Massachusetts 2¾s, $2,000,000; Buffalo, N. Y., 3.4s, $2,210,000, general improvement.

Cumulatively, new capital for construction, Jan. 1 to Sept. 12, inclusive, reached a total of 2,736 millions, compared with 5,032 millions in the corresponding period of 1930—a decrease of 45.7 per cent. Contract letting in the same period was 23.2 per cent under the 1930 total.





Hoover Dam Notes

Considerable progress was made in tunneling during the week ended Sept. 8. Both adits are now completed to the outer diversion tunnels. Pioneer headings totaling 1,369 ft. have been pushed both ways from the adit and from the south portal of the inner Nevada tunnel. Similar headings being driven from both portals and both ways from the adit on the inner Arizona tunnel now total 1,849 ft., with but 190 ft. to go between the south portal and adit headings.

Wide publication of the fact that the workmen at Hoover Dam had walked out has led to another large influx of laborers who would be glad to step into the jobs that were being vacated. It has been necessary to disappoint these new arrivals. Practically all of the strikers returned to their jobs. Since that time it has been necessary to reduce the force by 150 men, due to the completion of the Boulder City-Hoover Dam railroad. During the week ended Sept. 8 the total number on the payroll was 2,150.

The grading of the storage yard at the Boulder City warehouse has been completed. Six Companies will begin construction immediately on 100 two-room residences so as to provide better housing for the men who have been camping at Williamsville.

Desilted water pumped from the river to the receiving tank at Boulder City for the first time on Sept. 1. Unfiltered water will be used for construction purposes until the permanent treating plant is placed in operation.

Cast-Iron Paving Being Tried in England

Cast-iron paving, in the form of triangular plates bedded in a bituminous composition on a concrete base, is being tried for 300 ft. on a busy street in London, England. As compared with other surfacing materials the inventor, Frank Small, is reported to claim that cast iron is cheaper than the cheapest granite block, can be used at once instead of waiting several days as with wood block, can be repaired or renewed quickly, has a minimum of noise and vibration and will not cause skidding.

Prevailing Wage on Highways Set in California

The first highway wage scale of pay for workers on state projects as required under the newly enacted prevailing-wage law has been announced by the California department of public works. The scale was set for two highway jobs, one in northern and one in southern California. The following are the wages provided in the scale:

	No. Calif.	So. Calif
Common laborers	$4.00	$4.00
Tractor drivers	7.00	6.50
Power shovel and crane operators	10.00	10.00
Firemen	7.00	7.00
Oilers	6.00	6.00
Grader operators	6.00	6.00

Personal Notes

CHARLES L. WILSON, division engineer in the Oklahoma department of highways, has been made state highway engineer, succeeding A. R. Losh, who resigned to become city manager of Oklahoma City.

F. M. PLAKE, chief engineer of the Missouri Public Service Commission, has resigned to become valuation engineer of the Union Electric Light & Power Co., of St. Louis. He will be succeeded by J. E. FLANDERS, now assistant chief engineer.

CHARLES P. MILLS, recently director of the chrome alloy department of the General Alloy Co., has resigned to become chief engineer of Empire Steel Castings, Inc., of Reading, Pa.

A. V. GUILLOU, for the past 4½ years assistant chief engineer for the California railroad commission, has resigned to become chief engineer of the newly reorganized Public Service Commission of Wisconsin.

JERRY DONOHUE, of Sheboygan, highway engineer of Wisconsin, has resigned, and his place on the Wisconsin state highway commission has been taken by JOHN C. SCHMIDTMAN, of Manitowoc.

GLENN B. WOODRUFF has been appointed designing engineer of the San Francisco Bay Bridge Commission on the trans-bay bridge from Oakland to San Francisco.

WILLIAM VON PHUL, JR., is manager of the branch office of the engineering organization of Ford, Bacon & Davis, Inc., recently opened in Dallas, Tex. He is also vice-president of the Ford, Bacon & Davis Construction Corp., a subsidiary, which is also operating in the Texas city.

E. R. DAVIS, manager of construction of the Southern California Edison Co., Ltd., since 1921, has been appointed manager of construction and engineering for the company.

EARL F. MILLER, engineer and architect, Appleton, Wis., has closed his Appleton office and will open an office in Los Angeles, Calif.

FRANK F. HEALEY and JAMES H. WATT have formed the partnership of Healey & Watt, with offices in Chicago, and will act as consulting engineers on all types of construction work. Mr. Healey has been engaged in civil engineering for more than three decades and Mr. Watt was associated with the McClintic-Marshall Co. for seven years and later with Allen & Garcia, consulting engineers.

EDWARD G. ROST, water engineer of Baltimore, has made application for retirement and will be placed on the pension roll on Oct. 1. Mr. Rost first entered the employ of the Baltimore water department in 1897 and served until 1911. He reentered the service in 1921, and in 1927 was made water engineer.

Obituary

ALBERT FRANCIS, 84 years of age, who was engaged in the contracting business in Baltimore for many years, retiring a few years ago, died on Sept. 2.

HAROLD L. RICHARDSON, chief engineer of the Kay Engineering Co., of New York City, died on Sept. 4 in Fulton, N. Y., his native town.

ELMER ZARBELL, assistant engineer in charge of bridge construction for the Louisville & Nashville Railroad Co., died in Louisville, Ky., on Sept. 10. Mr. Zarbell, who was 55 years old, was graduated from Cornell and first did construction work in Central America. He had been connected with the Louisville & Nashville for 32 years.

THOMAS YARWOOD, of Memphis, Tenn., died on Sept. 6, aged 79 years. Mr. Yarwood was a native of Manchester, England, but went to Memphis as a youth. He built the first skycraper erected in Memphis, and also many public and semi-public buildings.

MILES GRANT HORNADAY, president of the Hornaday Paving Co., of Memphis, Tenn., died of a heart attack on Sept. 7. He was 61 years old. Mr. Hornaday went to Memphis from Indianapolis, and in the last 25 years did much work in Alabama, Louisiana, Mississippi, Arkansas and Tennessee on both highway and city projects. He had been inactive for a year because of ill health.

HARRY PHILLIPS DAVIS, vice-president and director of the Westinghouse Electric & Mfg. Co. and chairman of the National Broadcasting Co., died on Sept. 10 at his home in Pittsburgh. Mr. Davis was responsible for many of the most important advances in the electrical field, in the perfecting of meters, measuring instruments, circuit breakers, railway control apparatus, transmission equipment, and radio. He was in charge of the Westinghouse engineering department for more than 21 years, and for 15 years directed its engineering and manufacturing operations. He accomplished the electrification of the New York, New Haven & Hartford Railroad.

WILLIAM EDWIN SCOTT, treasurer of Scott Brothers Construction Co., Inc., which has offices at Rome and Rochester, N. Y., died suddenly in Rome, N. Y., on Sept. 6 at the age of 62. Mr. Scott had been associated with his brothers, Robert G. Scott and James P. Scott, in the contracting business for the past 34 years. Under the partnership name of Scott Brothers they did considerable railroad and bridge construction in the Central and Southern states, and in 1908 moved from Virginia to New York State, and specialized in bridge, sewer and water contracts.

GEORGE C. WHITE, highway engineer, died on Aug. 18 at Auburn, Calif., following an appendicitis operation on the morning of Aug. 13. Mr. White, who was born on June 30, 1868, in Illinois, studied two years at Kansas State University and began engineering work as axman on the Union Pacific Railroad. He continued on railroad work for many years, filling positions as locating engineer and construction engineer on various roads. He was field engineer for the city of Oakland for eight years and entered the U. S. Bureau of Public Roads on July 22, 1919. For the past five years he had worked as supervising engineer in northern California.

A. R. PONDER, executive assistant to the vice-president of the Missouri Pacific Railroad lines in Texas, died suddenly at Asherton, Tex., on Sept. 10. He was 64 years old. Before going to Texas he had served as assistant chief engineer of the Cape Girardeau & Fort Smith Railway and with the St. Louis, Kennett & Southern, now part of the St. Louis-San Francisco Railway. In 1909 he went to Crystal City, Tex., to become president of the Crystal City & Uvalde Railroad, now the San Antonio, Uvalde & Gulf Railroad. He served that road as president, receiver and general manager until 1926, when it was taken over by the Missouri Pacific. In 1926 he was made executive assistant to the vice-president of the Missouri Pacific in Texas. His home was in San Antonio.

SOCIETY CALENDAR

AMERICAN ASSOCIATION OF ENGINEERS, Chicago; annual convention, Huntington, W. Va., Sept. 28-30.

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS, Washington, annual meeting, Sept. 28-Oct. 1, Salt Lake City.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; fall meeting, St. Paul, Minn., Oct. 7-9.

AMERICAN SOCIETY OF MUNICIPAL ENGINEERS, St. Louis; meeting, Oct. 19-26, Pittsburgh.

AMERICAN WELDING SOCIETY, New York City; fall meeting, Sept. 21-25, Boston.

INTERNATIONAL CITY MANAGERS ASSOCIATION, Chicago; annual meeting, Oct. 7-10, Louisville, Ky.

INTERNATIONAL ASSOCIATION OF PUBLIC WORKS OFFICIALS, Chicago; conference, Sept. 24-26, New York City.

NATIONAL MUNICIPAL LEAGUE, New York City; annual meeting, Nov. 9-11, Buffalo, N. Y.

NATIONAL SAFETY COUNCIL, New York City; twentieth annual safety congress, Chicago, Oct. 12-16.

NEW ENGLAND WATER WORKS ASSOCIATION, Boston; annual convention, Sept. 29-Oct. 2, Boston.

NATIONAL SAFETY COUNCIL will hold its twentieth annual safety congress and exposition in Chicago Oct. 12-16. The street and highway traffic section will be addressed by experts from all over the United States. Among the topics to be discussed will be hazardous street locations, what parking limitation has accomplished, traffic signals and accidents and use of accident records for highway safety. On the afternoon of Oct. 13 there will be an exhibition and demonstration of important features of traffic regulation and control in Grant Park.

SOUTHWEST WATER WORKS ASSOCIATION will hold its twentieth annual convention in New Orleans Oct. 19-22. An exhibition of equipment will be held in conjunction with the convention.

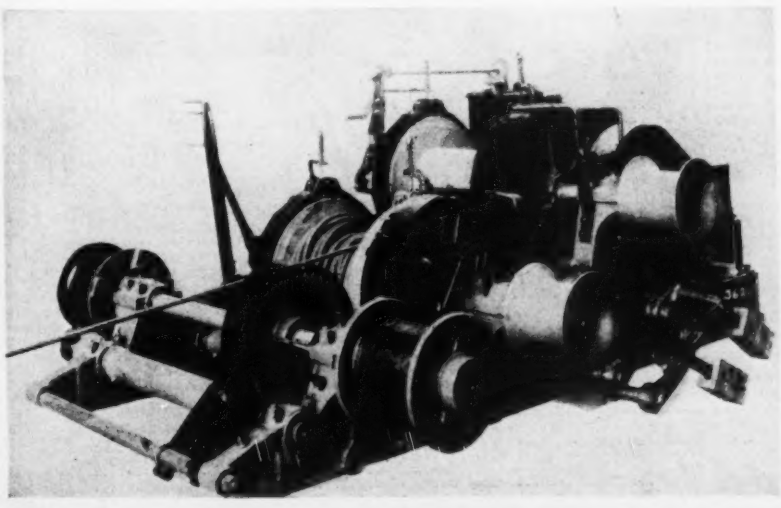
Construction Equipment and Materials

Crawler Mounted Tractor

A new heavy-duty Trackson crawler, known as the model GC, has been announced by the Trackson Co., Milwaukee, Wis., for attachment to the industrial tractor manufactured by the J. I. Case Co., Racine, Wis. The design not only is suited to drawbar work but also provides for the inbuilding of either front, side or rear-end special equipment. The motor unit does not overbalance the front end, but is centered fore and aft between the crawlers. Extra-heavy crawler frames, truck wheels and bearings provide ample strength for the superimposed loads of extra equipment. Wide clearance between the crawlers and motor permits quick, secure attachment and easy adjustment or lubrication. The crawlers are of all-steel construction; the track shoes are of heavy electric alloy steel, cast in one piece and specially corrugated to grip the road surface securely.

Gravity-Operated Safety Brake for Hoists

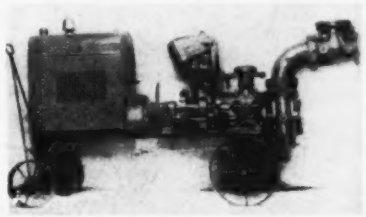
Simplicity is the keynote of the new patented, mechanically operated safety device for attachment to contractors' hoists which has been developed by the J. S. Mundy Hoisting Engine Co., Newark, N. J. Component parts include a safety brake, brake band, brake lever arm, operating weight and a connection to the operator's foot lever by means of an arm or roller. Pressure of the operator's foot on the service brake lever releases the safety brake and permits operation of the hoist as usual. If for any reason the operator should become disabled or should take his foot off the foot lever, the safety brake weight will drop, lift the operating foot lever, free the working brake and set the safety brake, which is capable of holding the load without causing undue strain on the hoisting cable.



Hoist equipped with gravity safety brake

Self-Priming Centrifugal Pumps

A line of self-priming centrifugal pumping units for contractors' service has been developed by the Lawrence Pump & Engine Co., 90 West St., New York City, in sizes of 3, 4, 5, 6 and 8 in., with capacities ranging from 150 to 2,000 g.p.m. Mountings available include a channel iron base and skids or a heavy four-wheel steel truck.



6-in. self-priming centrifugal pump

The pumping units used are the Lawrence Vortex type with side suction open impellers and are designed with unusually large water passages so that mud, grit, sand or other foreign matter can be handled without clogging. The automatic priming unit consists of a positive displacement vacuum pump, a vacuum control chamber and an air-tight check valve on the centrifugal pump discharge. The vacuum pump is driven from the main pump shaft by a silent chain inclosed in an oiltight case. The vacuum control chamber regulates the vacuum in the centrifugal pump and suction pipe, and automatically opens a port to the atmosphere when the centrifugal pump is primed and pumping. Under intermittent operation, such as clearing a small amount of water from a trench, the vacuum pumping unit operates continuously, but when it is not needed a friction clutch coupling can be disconnected by hand.

Power units on all sizes are four-cylinder motors of LeRoi or Hercules make, developing from 10 to 35 hp. On the three larger models clutch couplings are furnished between the engines and the pumps. Units are also available with electric motor drive.

Large-Capacity Bucket Loader

To meet the demands of truck fleet operators for a loader of greater capacity than has previously been built in order to reduce truck loading time, the George Haiss Mfg. Co., Inc., 141st St. and Park Ave., New York City, has introduced the new model 80 Haiss loader, said to have a capacity in excess of 3 cu.yd. per minute, even under difficult conditions. The weight of this new machine is 16,500 lb. Manganese steel is used at vital parts to assure lowest maintenance and replacement parts. Power is provided by a 60-hp. six-cylinder motor, equipped with air cleaner, oil filter, gasoline strainer and inbuilt throttling governor. The transmission is fully inclosed, all gears running in oil. Buckets measure 22x12x10 in. and are toothed for easier digging. The bucket elevator is interchangeable with a flight-conveyor snow boom for winter snow loading. Like other Haiss outfits, the model 80 is equipped with the revolving propeller feeding device and has a crowding speed of 3 ft. per minute.

Large bucket loader

Small Four-Cylinder Motor

With the announcement of two small four-cylinder engines in sizes of 10 and 20 hp. the Waukesha Motor Co., Waukesha, Wis., opens a new field to its

(*Continued on page 472*)

Current Construction Unit Prices

Excavation and Track Items, Wichita Sewage-Disposal Plant

THREE contracts were awarded July 2, 1931, for the construction of a sewage-disposal plant at Wichita, Kan.: (1) 2,200 lin.ft. of 7-ft. chain link fence to the Wichita Fence & Supply Co. at $1.19; (2) 69,000 cu.yd. sand fill and embankment to the Independent Sand & Gravel Co. at $1.71; (3) remainder of plant to M. L. Gillioz, Monet, Mo., for $307,368. The accompanying tabulation gives the three low bids on the principal excavation and track items of the last contract, totaling $36,071 for low bid. A: M. L. Gillioz (contract); B: H. W. Underhill and W. B. Carter; C: L. F. Smith. Black & Veatch, Kansas City, are consulting engineers. P. L. Brockway is city engineer.

TRACK AND EXCAVATION, WICHITA SEWAGE PLANT

Excavation for Structure:	A	B	C
2,000 cu.yd. top soil	$1.00	$0.45	$0.50
13,000 cu.yd. above El. 80	0.40	0.25	0.45
5,000 cu.yd. below El. 80	1.00	0.30	0.30
Additional Excavation from Borrowpits:			
6,000 cu.yd. top soil	0.50	0.25	0.40
50,000 sta.yd. overhaul	0.02	0.03	0.02
Fill and embankments of sand	0.20	0.20	0.17
Track for Moving Dried Sludge:			
4,050 ft. on concrete walls	1.50	1.10	0.90
1,150 ft. on fill	1.75	1.65	1.75
100 ft. on exposed trestle	1.75	1.00	1.00
100 ft. on buried trestle	2.00	1.50	2.00

48-In. Cast-Iron Outfall in Chester, Pa.

CONTRACT 14 of Delaware River outfall sewer, awarded in August, 1931, by the city of Chester, Pa., for $113,290, consists of 1,250 ft. of 48-in. cast-iron pipe extending over the Delaware River tidal flats and a 48-in. cast-iron submerged outfall sewer extending from the end of the first section some 520 ft. along the bed of the river. Included also are an inshore junction chamber, a foundation crib and a buoy, marking the end of the outfall sewer. From the inshore junction chamber to a point near the U. S. government bulkhead line, a distance of 1,224 ft., the sewer is constructed on concrete pile bents and grillage with the invert 1½ to 4½ ft. above mean low tide. The greater part of the work is in tidal water which is under the jurisdiction of the government.

Of the total contract, 90 per cent of the cost is for furnishing and laying the 48-in. class A bell and spigot cast-iron pipe and specials, with pile caps and grillage supports, and for the 48-in. ball-and-socket pipe along the bed of the river. Contract price of the 1,260 lin.ft., mostly on piles, was $60, and the average for the seven bids received was $47. Contract price for the 520 ft. under the river was $50; average price $62. The only other item of consequence is for furnishing and placing composite piles. The contract price for the 5,300 lin.ft. of these was $1.25; the average bid was $2.32.

The contractor is the Tuller Construction Co., Red Bank, N. J. C. J. Hunter is director of street and public improvements, Chester.

Paving and Sewer Costs in Cleveland

COMPARATIVE prices of paving and sewer items for the city of Cleveland, Ohio, are given in the accompanying three tables. Table II, compiled from data furnished by Ray Miller, assistant engineer in the department of public

TABLE I—UNIT PRICES OF SEWERS, 1929

Size and Type	Tunnel	Open Cut—Depth in Feet to Flow Line 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total Length, All Depths Feet
		$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	
8" V.C.P. and 12" V.C.P.								2.70											566
8" V.C.P.		2.00						1.80		1.00		1.10	0.70						1,014
12" C.I.P. Class "B"						4.00						3.00*							90
12" V.C.P.	$5.56	1.10	3.00	2.50	1.50	2.25*	1.40	1.50	1.61	1.43	1.93	1.57		1.33		2.00			38,329
15" V.C.P.	9.85					1.40	1.67	2.12	1.91	2.35	1.57	1.59	1.55	2.65		3.60			11,471
18" V.C.P.	8.00			3.00		1.80		1.94	2.06	2.07	3.50	2.55	1.95		2.00	4.00			12,214
20" C.I.P. Class "B"											6.00								24
20" V.C.P.				4.00		2.12				2.75	2.15			2.42					3,272
24" C.I.P. Class "B"												10.50							48
24" V.C.P.				5.00	5.50*		3.00	3.20	3.50	7.00†		6.25		3.15	4.50	7.25†	4.00		14,229
27" V.C.P.										5.03	3.90			4.50		3.05			580
30" V.C.P.											5.00				8.00				635
30" concrete pipe					5.75					4.40	4.70								1,135
2'-9" cir. 2-ring brick								8.00				8.00							635
3'-0" cir. 2-ring brick	10.00					7.00				23.75 15.03				8.00					2,141
3'-0" concrete pipe		6.50					4.80					5.40							2,221
3'-3" concrete pipe							5.40												700
3'-3" cir. 2-ring brick	15.70											9.10		9.80	11.50				1,120
3'-6" cir. 2-ring brick	15.50											10.30			10.00			10.40	449
3'-9" concrete pipe						7.00													720
3'-9" 2-ring brick										15.00		26.00† 11.00	9.80		11.00				947
4'-0" cir. 2-ring brick												11.00							220
4'-3" cir. 2-ring brick	20.00										14.50								702
4'-6" cir. 2-ring brick														26.50†	14.15				610
4'-9" cir. 2-ring brick															27.00†		15.00		1,435
5'-0" cir. 2-ring brick	23.00																		1,580
5'-3" cir. 3-ring brick															21.75				270
5'-6" cir. 3-ring brick																		21.75	2,728
5'-9" cir. 3-ring brick	65.00																		35
5'-9" cir. equivalent brick																	20.00		2,740
6'-6" cir. equiv. brick						24.75													305
6'-6" cir. 3-ring brick	67.00																		537
6'-9" cir. 3-ring brick	74.00																		1,060
9'-0" cir. 3-ring brick	47.00																		2,090
No. 3 2-ring brick											8.00					9.50			345
No. 4 2-ring brick							24.25					9.61							274
No. 5 2-ring brick												9.50							305
No. 7 2-ring brick												10.50							380
No. 8 2-ring brick	*																11.50		456
No. 9 2-ring brick	16.00															12.50			775
4'x8' conc. box				20.00		18.50													1,883
5'x8' conc. box														22.85					2,089
6'x11' conc. box					32.00														143
(6'x6') + (6'x6') double barrel		56.00	(built on piling)																591
																		Total	113,607

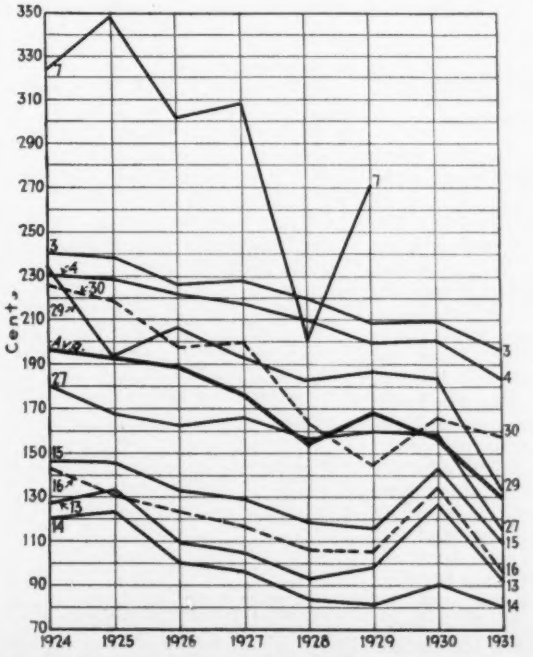
* Incased in concrete. † Silk mills job-acidproof mortar

TABLE II—AVERAGE LOW BIDS ON STREET LETTINGS IN CLEVELAND

	1924	1925	1926	1927	1928	1929	1930	1931
1—Excavation, cu.yd.	$0.93	$0.96	$0.71	$0.55	$0.52	$0.37	$0.71	$0.44
2—5-in. brick on sand, sq.yd.	3.10			3.05	3.95			
3—4-in. brick (asphalt), sq.yd.	2.41	2.39	2.27	2.28	2.20	2.09	2.10	1.97
4—4-in. brick (grout), sq.yd.	2.31	2.29	3.27	2.18	2.10	2.00	2.01	1.84
5—5-in. brick, sq.yd.					2.35			2.45
6—2½-in. brick (asphalt), sq.yd.	2.46			1.92	1.82	4.58	1.62	1.45
7—Rein. concrete (2-8), sq.yd.	3.24	3.49	3.02	3.09	2.01	2.71		
8—Rein. concrete (2-7), sq.yd.	3.19	3.22	2.81	2.92	2.88	2.64	2.80	
9—Rein. concrete (1-8), sq.yd.								
10—Rein. concrete (1-7), sq.yd.					3.04	1.63		2.09
11—Bit. conc. trap rock (lake), sq.yd.				1.06	1.03	.95	.98	.86
12—Bit. conc. trap rock (oil), sq.yd.				.99	.96	.87	.90	.80
13—Bit. conc. (lake), sq.yd.	1.28	1.33	1.10	1.05	.93	.98	1.27	.93
14—Bit. conc. (oil), sq.yd.	1.20	1.24	1.01	.97	.84	.82	.91	.81
15—3-in. sheet asphalt (lake), sq.yd.	1.47	1.46	1.33	1.29	1.19	1.16	1.44	1.09
16—3-in. sheet asphalt (oil).	1.43	1.31	1.24	1.17	1.07	1.06	1.35	.96
17—1½-in. sheet asphalt (lake), sq.yd.					.83		.90	
18—1½-in. sheet asphalt (oil), sq.yd.					.75		.84	
19—Binder (lake), sq.yd.					8.10		8.51	6.79
20—Binder (oil), sq.yd.					7.58		7.85	6.20
21—D. B. Medina stone, sq.yd.			3.50	4.50	3.50		4.47	4.17
22—Granite block, sq.yd.			3.75	4.50	3.78		5.45	4.63
23—Puddling, sq.yd.		.01	.01	.01	.01	.004	.0082	.01
24—4-in. cushion blanket course, sq.yd.			.26	.30	.29	.22	.26	.18
25—Brick pavement relaid, sq.yd.	1.73	1.26	1.05	.90	.83	.58	.98	.62
26—Stone pavement relaid, sq.yd.	2.68	2.06	1.50	1.38	1.13		1.46	.87
27—6-in. conc. foundation, sq.yd.	1.80	1.68	1.63	1.66	1.57	1.60	1.59	1.14
28—7-in. conc. foundation, sq.yd.	1.79	1.92	1.80	1.78	1.69	1.76	1.81	1.36
29—8-in. conc. foundation, sq.yd.	2.34	1.94	2.07	1.93	1.83	1.87	1.84	1.33
30—5-in. granite curbing, lin.ft.	2.26	2.19	1.98	2.00	1.63	1.45	1.66	1.58
31—5-in. granite curb cut to radius, lin.ft.			2.35	2.31	2.20	1.94	2.06	1.75
32—5-in. Berea curbing, lin.ft.	1.07	1.10	1.08	1.06	1.06	1.02	1.10	.97
33—6-in. Berea curbing, lin.ft.					1.19	1.23	1.30	1.23
34—Curbstone reset, lin.ft.	.39	.29	.25	.26	.20	.15	.35	.26
35—5x16-in. conc. header, lin.ft.	.47	.42	.36	.25	.20	.13	.25	.09
36—New catch basin, each.	100.60	98.65	93.67	91.14	92.21	84.06	91.22	80.21
37—Old catch basin rebuilt, each.	27.45	21.97	12.83	12.10	8.99	8.54	18.98	9.43
38—Catch basin cover furnished, each.	25.84	23.56	18.83	16.39	15.49	11.71	18.43	19.10
39—Old catch basin cover reset, each.	4.97	4.62	3.50	3.87	3.54	2.27	4.05	2.29
40—New inlet basin, each.	38.98	36.75	27.83	25.28	24.84	18.56	32.16	24.43
41—Old catch basin cleaned, each.	3.76	4.63	4.05	4.91	4.61	3.36	4.83	3.52
42—Catch basin pipe (12 in.), lin.ft.	2.06	2.00	1.91	1.92	1.90	1.73	1.86	1.22
43—2½-in. cement walk, sq.ft.	.29	.25	.21	.18	.19	.14	.15	
44—4½-in. Berea flagging, sq.ft.	.30	.28	.28	.27	.26	.24	.23	
45—Flagging relaid, sq.ft.	.09	.08	.08	.07	.07	.06	.06	
46—42-lb. wire mesh complete in place, sq.yd.						.17	.18	.17
47—3-in. brick (asphalt), sq.yd.						1.63	1.67	1.59
48—Contraction joint, lin.ft.							.19	.14

service, gives the average low bid for street work in the years 1924 to 1931 inclusive. The chart shows the trend of pavement prices for these years for ten representative paving items. Numbers on the chart correspond with the numbers in the left-hand column of Table II.

Tables I and III were compiled by E. C. Richardson, engineer of sewer design for the city. These give unit prices of 1929 and 1930 on various sizes and classes of sewers and the quantities covered by the prices. Prices are for sewer in place and cover excavation and backfill but not such items as manholes. The variations in some of the prices, on the basis of depths, are due to soil conditions on the short length.



Average low bids for paving in Cleveland, Ohio

TABLE III—UNIT PRICES OF SEWERS, 1930

Depth to flow line in feet is given in parentheses. All work is in open cut except where indicated in tunnel (T)

Vitrified Clay except as otherwise stated:
8-in.: (5) $0.75; (7) $1.00; (8) $1.05; (10) $1.50; (11) $3.00. Total length 692 ft.
12-in. incased in concrete: (16) $2.75; (20) $5.00. Length 984 ft.
12-in.: (T) $5.09; (5) $1.13; (6) $1.22; (8) $1.37; (9) $1.76; (10) $1.53; (12) $1.72; (13) $1.70; (14) $2.79; (15) $3.25; (16) $1.90. Length 16,694 ft.
15-in.: (T) $7.59; (5) $1.65; (6) $1.60; (8) $1.46; (9) $2.20; (10) $1.61; (11) $2.04; (12 $2.25; (13) $3.00; (14) $3.80; (15) $2.50; (16) $2.74. 15,786 ft.
15-in. incased in concrete: (3) $2.00; (15) $3.70. 363 ft.
15-in. corrugated iron, asphalt painted: (30) $15.00. 15 ft.
16-in. cast-iron class B: (25) $20.00. 15 ft.
18-in.: (T) $7.00; (7) $2.22; (9) $2.50; (10) $4.00; (11) $3.50; (13) $2.87; (14) $4.15; (15) $5.50; 4,209 ft.
20-in. cast-iron: (30) $16.00. 20 ft.
20-in.: (T) $4.66; (6) $3.00; (8) $4.00; (9) $2.70; (10) $2.15; (12) $3.90; (15) $4.85. 3,202 ft.
24-in. incased in concrete: (1) $4.25; (15) $7.00. 3,151 ft.
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27-in.: (T) $20.00; (15) $6.00; (18) $8.50. 815 ft.
30-in. corrugated iron, asphalt painted: (5) $7.50. 30 ft.
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Brick—Two Rings except where stated 3 Rings:
2½ ft.: (3) $15.00; (12) $6.35. 620 ft.
2½ ft.: (12) $9.00. 1,212 ft.
3 ft.: (T) $20.11; (3) $7.00; (12) $12.25. 430 ft.
3½ ft.: (T) $25.00; (11) $7.00. 331 ft.
3½ ft.: (12) $10.25. 75 ft.
3½ ft., 3 rings: (15) $22.00. 112 ft.
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4 ft.: (T) $28.00; (5) $16.00; (13) $11.50. 1,362 ft.
4 ft., 3 rings: (4) $14.00. 20 ft.
4½ ft.: (17) $15.50. 346 ft.
4½ ft., 3 rings: (T) $33.00; (15) $21.43; (16) $23.00. 1,027 ft.
4½ ft.: (8) $10.00; (13) $13.95. 1,155 ft.
4½ ft., 3 rings: (5) $14.50. 149 ft.
5 ft.: (T) $23.00; (5) $15.00. 478 ft.
5½ ft.: (16) $19.65. 925 ft.
5½ ft.: (T) $23.00. 1,339 ft.
6 ft.: (T) $23.40. 1,850 ft.
6 ft., 3 rings: (15) $24.50. 274 ft.
6½ ft.: (15) $27.00. 10 ft.
7 ft.: (T) $37.00; (16) $29.50; (20) $24.85. 4,431 ft.
7½ ft.: (T) $42.40. 1,920 ft.
8 ft.: (T) $45.75. 3,488 ft.
8½ ft.: (T) $48.20. 2,515 ft.
9 ft.: (T) $47.00. 1,395 ft.
10 ft.: (T) $59.00. Length not given.
Standard Egg-Shaped, 2 Rings:
No. 2 type, area 3.41 sq.ft.: (13) $8.00; (15) $9.90. 113 ft.
No. 3, $4.75 sq.ft.: (T) $12.00; (13) $7.66. 3,128 ft.
No. 4, $6.35 sq.ft.: (14) $8.25. 360 ft.
No. 5, $8.55 sq.ft.: (T) $15.25. 995 ft.
No. 7, 3 rings, 13.39 sq.ft.: (T) $34.60. Length not given.
Concrete Box Culverts:
6x3 ft.: (12) $20.50. 1,000 ft.
3x12 ft.: (6) $36.15. 110 ft.
3x8 ft.: (10) $44.00. 166 ft.
6x8 ft.: (2) $22.00. 1,086 ft.
6x9 ft.: (2) $24.00. 254 ft.
8x12½: (1) $50.00. 31 ft.
2 (7x11½ ft.), double barrel: (6) $60.00. 90 ft.

Current Construction Unit Prices

Excavation and Track Items, Wichita Sewage-Disposal Plant

THREE contracts were awarded July 2, 1931, for the construction of a sewage-disposal plant at Wichita, Kan.: (1) 2,200 lin.ft. of 7-ft. chain link fence to the Wichita Fence & Supply Co. at $1.19; (2) 69,000 cu.yd. sand fill and embankment to the Independent Sand & Gravel Co. at $1.71; (3) remainder of plant to M. L. Gillioz, Monet, Mo., for $307,368. The accompanying tabulation gives the three low bids on the principal excavation and track items of the last contract, totaling $36,071 for low bid. A: M. L. Gillioz (contract); B: H. W. Underhill and W. B. Carter; C: L. F. Smith. Black & Veatch, Kansas City, are consulting engineers. P. L. Brockway is city engineer.

TRACK AND EXCAVATION, WICHITA SEWAGE PLANT

Excavation for Structure:	A	B	C
2,000 cu.yd. top soil	$1.00	$0.45	$0.50
13,000 cu.yd. above El. 80	0.40	0.25	0.45
5,000 cu.yd. below El. 80	1.00	0.30	0.30
Additional Excavation from Borrowpits:			
6,000 cu.yd. top soil	0.50	0.25	0.40
50,000 sta.yd. overhaul	0.02	0.03	0.02
Fill and embankments of sand	0.20	0.20	0.17
Track for Moving Dried Sludge:			
4,050 ft. on concrete walls	1.50	1.10	0.90
1,150 ft. on fill	1.75	1.65	1.75
100 ft. on exposed trestle	1.75	1.00	1.00
100 ft. on buried trestle	2.00	1.50	2.00

48-In. Cast-Iron Outfall in Chester, Pa.

CONTRACT 14 of Delaware River outfall sewer, awarded in August, 1931, by the city of Chester, Pa., for $113,290, consists of 1,250 ft. of 48-in. cast-iron pipe extending over the Delaware River tidal flats and a 48-in. cast-iron submerged outfall sewer extending from the end of the first section some 520 ft. along the bed of the river. Included also are an inshore junction chamber, a foundation crib and a buoy, marking the end of the outfall sewer. From the inshore junction chamber to a point near the U. S. government bulkhead line, a distance of 1,224 ft., the sewer is constructed on concrete pile bents and grillage with the invert 1½ to 4½ ft. above mean low tide. The greater part of the work is in tidal water which is under the jurisdiction of the government.

Of the total contract, 90 per cent of the cost is for furnishing and laying the 48-in. class A bell and spigot cast-iron pipe and specials, with pile caps and grillage supports, and for the 48-in. ball-and-socket pipe along the bed of the river. Contract price of the 1,260 lin.ft., mostly on piles, was $60, and the average for the seven bids received was $47. Contract price for the 520 ft. under the river was $50; average price $62. The only other item of consequence is for furnishing and placing composite piles. The contract price for the 5,300 lin.ft. of these was $1.25; the average bid was $2.32.

The contractor is the Tuller Construction Co., Red Bank, N. J. C. J. Hunter is director of street and public improvements, Chester.

Paving and Sewer Costs in Cleveland

COMPARATIVE prices of paving and sewer items for the city of Cleveland, Ohio, are given in the accompanying three tables. Table II, compiled from data furnished by Ray Miller, assistant engineer in the department of public

TABLE I—UNIT PRICES OF SEWERS, 1929

Size and Type	Tunnel	Open Cut—Depth in Feet to Flow Line 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total Length, All Depths Feet
8″ V.C.P. and 12″ V.C.P.								2.70											566
8″ V.C.P.		2.00						1.80		1.00		1.10	0.70						1,014
12″ C.I.P. Class "B"						4.00						3.00*							90
12″ V.C.P.	$5.56	1.10	3.00	2.50	1.50	2.25*	1.40	1.50	1.61	1.43	1.93	1.57		1.33		2.00			38,329
15″ V.C.P.	9.85					1.40	1.67	2.12	1.91	2.35	1.57	1.59	1.55	2.65		3.60			11,471
18″ V.C.P.	8.00			3.00		1.80		1.94	2.06	2.07	3.50	2.55	1.95		2.00	4.00			12,214
20″ C.I.P. Class "B"											6.00								24
20″ V.C.P.				4.00		2.12				2.75	2.15			2.42					3,272
24″ C.I.P. Class "B"												10.50							48
24″ V.C.P.				5.00	5.50*		3.00	3.20	3.50	7.00† 5.03	3.90	6.25		3.15	4.50	7.25† 3.05	4.00		14,229
27″ V.C.P.														4.50					580
30″ V.C.P.											5.00				8.00				635
30″ concrete pipe					5.75					4.40	4.70								1,135
2′-9″ cir. 2-ring brick								8.00				8.00							635
3′-0″ cir. 2-ring brick	10.00					7.00				23.75 15.03				8.00					2,141
3′-0″ concrete pipe		6.50					4.80					5.40							2,221
3′-3″ concrete pipe							5.40												700
3′-3″ cir. 2-ring brick	15.70											9.10		9.80	11.50				1,120
3′-6″ cir. 2-ring brick	15.50											10.30			10.00			10.40	449
3′-9″ concrete pipe						7.00													720
3′-9″ 2-ring brick										15.00		26.00† 11.00	9.80		11.00				947
4′-0″ cir. 2-ring brick												11.00							220
4′-3″ cir. 2-ring brick	20.00										14.50								702
4′-6″ cir. 2-ring brick														26.50†	14.15				610
4′-9″ cir. 2-ring brick															27.00†		15.00		1,435
5′-0″ cir. 2-ring brick	23.00																		1,580
5′-3″ cir. 3-ring brick															21.75				270
5′-6″ cir. 3-ring brick																		21.75	2,728
5′-9″ cir. 3-ring brick	65.00																		35
5′-9″ cir. equivalent brick																	20.00		2,740
6′-6″ cir. equiv. brick						24.75													305
6′-6″ cir. 3-ring brick	67.00																		537
6′-9″ cir. 3-ring brick	74.00																		1,060
9′-0″ cir. 3-ring brick	47.00																		2,090
No. 3 2-ring brick											8.00					9.50			345
No. 4 2-ring brick							24.25					9.61							274
No. 5 2-ring brick												9.50							305
No. 7 2-ring brick												10.50							380
No. 8 2-ring brick																	11.50		456
No. 9 2-ring brick	16.00															12.50			775
4′x8′ conc. box				20.00		18.50													1,883
5′x8′ conc. box														22.85					2,089
6′x11′ conc. box					32.00														143
(6′x6′) + (6′x6′) double barrel		56.00	(built on piling)																591
																		Total	113,607

* Incased in concrete. † Silk mills job-acidproof mortar

TABLE II—AVERAGE LOW BIDS ON STREET LETTINGS IN CLEVELAND

	1924	1925	1926	1927	1928	1929	1930	1931
1—Excavation, cu.yd	$0.93	$0.96	$0.71	$0.55	$0.52	$0.37	$0.71	$0.44
2—5-in. brick on sand, sq.yd	3.10			3.05	3.95			
3—4-in. brick (asphalt), sq.yd	2.41	2.39	2.27	2.28	2.20	2.09	2.10	1.97
4—4-in. brick (grout), sq.yd	2.31	2.29	3.27	2.18	2.10	2.00	2.01	1.84
5—5-in. brick, sq.yd					2.35			2.45
6—2½-in. brick (asphalt), sq.yd	2.46			1.92	1.82	1.58	1.62	1.45
7—Rein. concrete (2–8), sq.yd	3.24	3.49	3.02	3.09	2.01	2.71		
8—Rein. concrete (2–7), sq.yd	3.19	3.22	2.81	2.92	2.88	2.64	2.80	
9—Rein. concrete (1–8), sq.yd								
10—Rein. concrete (1–7), sq.yd					3.04	1.63		2.09
11—Bit. conc. trap rock (lake), sq.yd				1.06	1.03	.95	.98	.86
12—Bit. conc. trap rock (oil), sq.yd				.99	.96	.87	.90	.80
13—Bit. conc. (lake), sq.yd	1.28	1.33	1.10	1.05	.93	.98	1.27	.93
14—Bit. conc. (oil), sq.yd	1.20	1.24	1.01	.97	.84	.82	.91	.81
15—3-in. sheet asphalt (lake), sq.yd	1.47	1.46	1.33	1.29	1.19	1.16	1.44	1.09
16—3-in. sheet asphalt (oil)	1.43	1.31	1.24	1.17	1.07	1.06	1.35	.96
17—1½-in. sheet asphalt (lake), sq.yd					.83		.90	
18—1½-in. sheet asphalt (oil), sq.yd					.75		.84	
19—Binder (lake), sq.yd					8.10		8.51	6.79
20—Binder (oil), sq.yd					7.58		7.85	6.20
21—D. B. Medina stone, sq.yd			3.50	4.50	3.50		4.47	4.17
22—Granite block, sq.yd			3.75	4.50	3.78		5.45	4.63
23—Puddling, sq.yd		.01	.01	.01	.01	.004	.0082	.01
24—4-in. cushion blanket course, sq.yd			.26	.30	.29	.22	.26	.18
25—Brick pavement relaid, sq.yd	1.73	1.26	1.05	.90	.83	.58	.98	.62
26—Stone pavement relaid, sq.yd	2.68	2.06	1.50	1.38	1.13		1.46	.87
27—6-in. conc. foundation, sq.yd	1.80	1.68	1.63	1.66	1.57	1.60	1.59	1.14
28—7-in. conc. foundation, sq.yd	1.79	1.92	1.80	1.78	1.69	1.76	1.81	1.36
29—8-in. conc. foundation, sq.yd	2.34	1.94	2.07	1.93	1.83	1.87	1.84	1.33
30—5-in. granite curbing, lin.ft	2.26	2.19	1.98	2.00	1.63	1.45	1.66	1.58
31—5-in. granite curb cut to radius, lin.ft			2.35	2.31	2.20	1.94	2.06	1.75
32—5-in. Berea curbing, lin.ft	1.07	1.10	1.08	1.06	1.06	1.02	1.10	.97
33—6-in. Berea curbing, lin.ft					1.19	1.23	1.30	1.23
34—Curbstone reset, lin.ft	.39	.29	.25	.26	.20	.15	.35	.26
35—5x16-in. conc. header, lin.ft	.47	.42	.36	.25	.20	.13	.25	.09
36—New catch basin, each	100.60	98.65	93.67	91.14	92.21	84.06	91.22	80.21
37—Old catch basin rebuilt, each	27.45	21.97	12.83	12.10	8.99	8.54	18.98	9.43
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40—New inlet basin, each	38.98	36.75	27.83	25.28	24.84	18.56	32.16	24.43
41—Old catch basin cleaned, each	3.76	4.63	4.05	4.91	4.61	3.36	4.83	3.52
42—Catch basin pipe (12 in.), lin.ft	2.06	2.00	1.91	1.92	1.90	1.73	1.86	1.22
43—2½-in. cement walk, sq.ft	.29	.25	.21	.18	.19	.14	.15	
44—4½-in. Berea flagging, sq.ft	.30	.28	.28	.27	.26	.24	.23	
45—Flagging relaid, sq.ft	.09	.08	.08	.07	.07	.06	.06	
46—42-lb. wire mesh complete in place, sq.yd						.17	.18	.17
47—3-in. brick (asphalt), sq.yd						1.63	1.67	1.59
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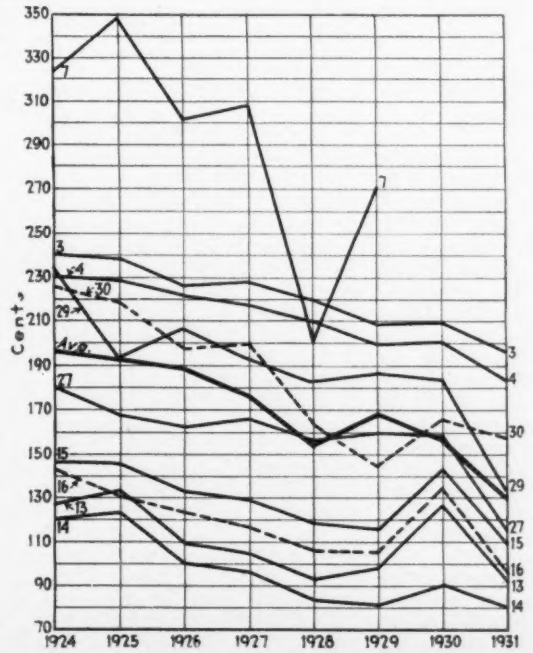

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15-in.: (T) $7.59; (5) $1.65; (6) $1.60; (8) $1.46; (9) $2.20; (10) $1.61; (11) $2.04; (12 $2.25; (13) $3.00; (14) $3.80; (15) $2.50; (16) $2.74. 15,786 ft.
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4½ ft.: (8) $10.00; (13) $13.95. 1,155 ft.
4½ ft., 3 rings: (5) $14.50. 149 ft.
5 ft.: (T) $23.00; (5) $15.00. 478 ft.
5½ ft.: (16) $19.65. 925 ft.
5½ ft.: (T) $23.00. 1,339 ft.
6 ft.: (T) $23.40. 1,850 ft.
6 ft., 3 rings: (15) $24.50. 274 ft.
6½ ft.: (15) $27.00. 10 ft.
7 ft.: (T) $37.00; (16) $29.50; (20) $24.85. 4,431 ft.
7½ ft.: (T) $42.40. 1,920 ft.
8 ft.: (T) $45.75. 3,488 ft.
8½ ft.: (T) $48.20. 2,515 ft.
9 ft.: (T) $47.00. 1,395 ft.
10 ft.: (T) $59.00. Length not given.

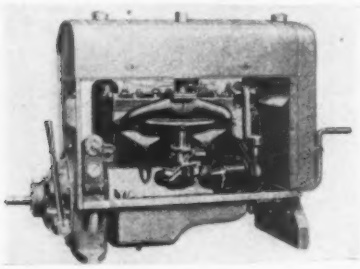
Standard Egg-Shaped, 2 Rings:
No. 2 type, area 3.41 sq.ft.: (13) $8.00; (15) $9.90. 113 ft.
No. 3, $4.75 sq.ft.: (T) $12.00; (13) $7.66. 3,128 ft.
No. 4, $6.35 sq.ft.: (14) $8.25. 360 ft.
No. 5, $8.55 sq.ft.: (T) $15.25. 995 ft.
No. 7, 3 rings, 13.39 sq.ft.: (T) $34.60. Length not given.

Concrete Box Culverts:
6x3 ft.: (12) $20.50. 1,000 ft.
3x12 ft.: (6) $36.15. 110 ft.
3x8 ft.: (10) $44.00. 166 ft.
6x8 ft.: (2) $22.00. 1,086 ft.
6x9 ft.: (2) $24.00. 254 ft.
8x12½: (1) $50.00. 31 ft.
2 (7x11½ ft.), double barrel: (6) $60.00. 90 ft.

Small Four-Cylinder Motor

(Continued from page 469)

activities. The new motors have all the characteristics of the company's larger models, including standard Ricardo combustion chambers, short, stiff crankshafts supported by three bronze-backed replaceable bearings, full pressure oiling, built-in governors and detachable flywheel housings. Mountings are provided for all usual accessories, including oil filter, electric starting and lighting system and battery or magneto ignition.



Small industrial motor

Truck-Mounted Spray Gun Stripes Pavements

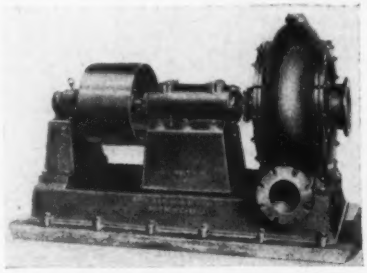
Laying down a uniform traffic line at a speed of from 6 to 8 m.p.h. is the function of a highway-striping outfit perfected by the DeVilbiss Co., Toledo, Ohio. This outfit, known as Type HS, can be attached to either the right or the left running board of a truck, or can be used as a trailer from the rear. While it is substantially built, it is still light enough to be handled by one man. For running board attachment, the spraying device is fastened to the truck by a clamp which holds a horizontal drawbar in position. Provision is made for adjustment to fit various heights of running boards. When traveling from one job to another the outfit can be lifted by a chain or rope leading to the driver's seat, thus permitting greater speed between jobs. The trailer type fastening is similar to the running board type, except that it has a vertical drawbar and bracket with clamping attachment bolted to the truck floor. A special toggle joint with spring tension frees the outfit from truck jars, and it is further cushioned by the rubber tires on its wheels.

Highway striper on rear of truck

The automatic spray gun is mounted on an arm between two metal disks, adjustable for stripe widths from 4 to 6 in. These disks are kept free from paint accumulation by a set of self-adjusting scrapers. Excess paint is deposited in the drip pan, and can be strained and re-used either in the gun or for hand painting at intersections. The gun is controlled by a hand valve operated from the truck.

Pumps for Abrasive Liquids

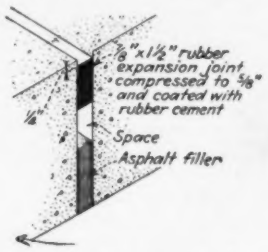
A new line of abrasive material handling pumps known as Type C has been added to the line of the American Manganese Steel Co., Chicago Heights, Ill. Many new features have been included in these units. Bearings are interchangeable in the field, either sleeve or anti-friction types being available. Lubrication is required only on main bearings, except where outboard bearings are used. Impeller clearance and main bearings can be easily adjusted without dismantling. The pumps are so designed that the bearings absorb all thrust and radial shocks. The material used in construction is manganese steel.



8-in. pump for abrasive liquids

Rubber Filler Seals Joints in Concrete Pavements

Strip rubber, to be installed under compression, is now being marketed by Goodrich Silvertown, Inc., the retail division of the B. F. Goodrich Co., Akron, Ohio, for use in sealing joints in concrete pavements. When the slab is poured, the joint opening is made by embedding a wood form which is removed when the concrete has attained its initial set. The lower section, not exceeding one-third of the vertical height of the opening, is then filled with asphalt and after this is completed, the rubber expansion strip is compressed into place. In doing this, both edges of the slab and the joint material itself are coated with rubber cement, after which the rubber is compressed by hand and shoved with the fingers into the joint. By the use of an ordinary steel bar 6 or 8 in. long the material can easily be pushed to the proper depth, which should be not less than ¼ in. below the surface of the pavement. The amount of compression of the rubber should be equal to the maximum contraction that will be expected in the concrete slab. By this arrangement, when the opening has reached its maximum size the rubber will be expanded to normal size and under opposite conditions with the joint nearly closed, it will not protrude above the pavement surface. The cemented strip is a watertight joint, which, it is claimed, will function for years without any maintenance.



Rubber pavement seal

Although this product has only recently been placed on the market, it has been in use for some time at service stations in different parts of the United States. Some of the earliest installations, now a year and a half old, show the rubber expansion joint in apparently as good a condition as when first installed. Arrangements are now being made for its use in test roads under the supervision of various state highway departments.

Business Notes

LaPlant-Choate Manufacturing Co., Inc., Cedar Rapids, Iowa, has taken over the exclusive manufacture of the patented hardpan plow formerly made by the Dukelow Hardpan Plow Co., Joplin, Mo. This unit was described in *ENR*, Feb. 26, 1931.

Toch Brothers, Inc., New York City, announces the retirement of Henry M. Toch, chairman of the board of directors of the Standard Varnish Works and president of Toch Brothers, Inc., effective Sept. 1. Maximilian Toch will succeed his brother as president of Toch Brothers, Inc., and will continue as vice-president of the Standard Varnish Works.

Worthington Pump & Machinery Corp., Harrison, N. J., has announced several important additions to its staff and also a number of organization changes. Otto Nonnenbruch, for the past four years chief engineer of the diesel department of I. P. Morris & De La Vergne, Inc., Philadelphia, Pa., is now special sales representative for Worthington, with headquarters at Buffalo, N. Y. J. B. Allen, formerly president of the Allen Engineering Co., Bridgeport, Conn., has been appointed special marine representative, with headquarters at Harrison. H. G. Wood, formerly assistant manager of the New England division, Westinghouse Electric & Mfg. Co., has been appointed electrical sales engineer. E. M. Paullin, Jr., formerly associated with the New York office of the General Electric Co., has been appointed electrical sales engineer at the Cincinnati, Ohio, works. John T. Clancy, assistant manager, Buffalo works sales division, has transferred his headquarters from Buffalo to Harrison. E. W. Hammond, formerly at Buffalo, has been transferred to Los Angeles as special representative of diesel and gas engine sales on the Pacific Coast. A. M. Boehm has been transferred from Buffalo to Kansas City as diesel and gas engine specialist. Joseph F. Hecking has been assigned to the diesel and gas engine sales division at Buffalo. William J. Daly, assistant manager, Cincinnati works sales division, has been assigned to Pittsburgh on special sales work. G. A. Herrmann, formerly sales engineer at Chicago, has been appointed acting district manager at St. Paul. W. R. Kennedy, sales engineer at Pittsburgh, has been appointed acting district manager at Kansas City.

CONSTRUCTION NEWS

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Some of the Week's Large Projects

For further details turn to the appropriate sections in this issue

Location	*Project*	*Cost*	*Status*
Waterworks			
Lincoln (Neb.)	Waterworks	$1,842,000	Bids asked
Bridges			
New York	Bridge	2,450,000	Bids asked
Streets and Roads			
Pembroke (Ont.)	Road	1,000,000	Day labor
Dams			
San Diego	Dam, etc.	5,000,000	Proposed
Federal Government			
Springfield (Mo.)	Hospital	2,500,000	Bids asked
Oregon	Irrigation project	1,500,000	Bids asked
Oregon	Jetty	1,204,606	Contract
Canal Zone	Dam	4,048,657	Contract
Buildings			
New York	Hospital	1,100,000	Contract
Wingdale (N. Y.)	Hospital	2,848,742	Contract
Toronto (Ont.)	Office	2,000,000	Proposed
Toronto (Ont.)	Office	1,500,000	Proposed
Bismarck (N. D.)	Capitol	2,000,000	Proposed
Jersey City	School	1,115,000	Proposed
New York	Court House	5,795,841	Contract
Nashville (Tenn.)	Theatre	1,500,000	Bids asked
Moscow (U.S.S.R.)	Palace of Soviets	10,000,000	Proposed

WATERWORKS

PROPOSED WORK

Calif., Los Angeles—Bd. Supervs. Los Angeles Co. rejected bids Aug. 10, steel storage tank for soft water at Los Angeles Co. General Hospital.

Calif., San Diego—See "Dams."

Utah, Salt Lake City—Conduit and 3 distributing reservoirs from Mountain Dell Reservoir to city intake in Parley's Canyon, 4 mi. 30 in. pipe, $680,000. H. Jessen, city engr.

Tex., Alice—City, waterworks extension, incl. pipe for mains. $12,000 voted for same. Address City Comrs. Bd., Alice.

Ont., Toronto—2¼ mi. trunk water-main from High Level Pumping Station to Roselawn Water Tower. $600,000. R. C. Harris, City Hall, engr.

BIDS ASKED

Conn., Rocky Hill—Sept. 21, by Rocky Hill Dist., laying 6 to 10-in. mains, valves, hydrants, service pipes, appurtenances. $15,000. C. M. Saville, 1026 Main St., Hartford, engr. Noted Aug. 6.

Ind., Petersburg—Oct. 5, at office Petersburg Water Filtration Corp., R. W. Dyer, pres. water filtration and pumping system. C. H. Hurd, 307 Mutual Insurance Bldg., Indianapolis, consult. engr.; adv. E. N.-R. Sept. 17.

Md., Baltimore—Sept. 23, by Bd. Awards, furnishing erecting pumping equipment for Pikesville Automatic Pumping Station; excavation, complete installation and backfill for 48 in. suction main for Ashburton Pumping Station. E. G. Rost, Municipal Bldg., water engr. Noted Sept. 3.

Mass., Boston—Sept. 21, by Dpt. P. Wks., J. A. Rourke, comr., laying, relaying water pipes, West Roxbury; Sept. 22, in Dorchester. $15,000.

Mich., Detroit—Sept. 22, by Bd. Water Comrs., 735 Randolph St., auxiliary piping system, incl. piping for control of hydraulically operated gate valves and automatic water operated check valves, piping and general service water piping for pumping and power plants, setting instruments and auxiliary piping for other miscellaneous work for Springwells Station. $25,000. G. H. Fenkell, 735 Randolph St., genl. mgr.

Neb., Lincoln—Sept. 22, by City Council, 19,645 ft. 24 to 36-in. c.i. pipe, appurtenances from city's well to proposed reservoir and pumping station near Ashland; also 132,600 ft. 36 in. c.i., steel, iron or rein.-con. water supply line appurtenances from pumping station to proposed reservoir and pumping station near Ashland. $1,842,000. D. L. Erickson, City Hall, engr.

N. Y., Spencerport—Sept. 29, by Bd. Village Trustees, Village Bldg., water pipe, laying water mains, reservoir, pumping equipment. W. S. Lozier, Inc., 10 Gibbs St., Rochester, consult engr.; adv. E. N.-R. Sept. 17.

Tex., Corpus Christi—Oct. 1 (extended date), by City at office T. Koister, city secy., rehabilitating, La Fruita Dam on Lake Lovenskiold. R. J. Cummins and H. E. Elrod, 1105 Nixon Bldg., Corpus Christi, or 727 Bankers Mortgage Bldg., Houston, consult. engrs. Noted Aug. 6.

CONTRACTS AWARDED

Calif., San Francisco—S. J. Hester, secy. Bd. P. Wks., City Hall, Crystal Springs Aqueduct (Hetch Hetchy Project), metal flumes across depressions, to MacDonald & Kahn, Financial Center Bldg., $125,485—Lower Cherry Aqueduct (Hetch Hetchy Project), to Steel Tank & Pipe Co. of California, 1100 4th St., Berkeley, $42,287.

Colo., Colorado Springs—Broadmoor Hotel Water & Power Co., laying 12 mi. 9- to 13-in. steel pipe and 1,500 ft. 4 x 6 ft. tunnel, to E. H. Honnen, Independence Bldg., $129,440.

Ind., Pendleton—Pendleton Water Co., drilling two 10 in. deep wells, also mains, fire hydrants, to Mead Constr. Co., 1027 Lemcke Bldg., Indianapolis. Est. $50,000. Noted Aug. 20.

N. J., Mountainview — Township Comn., Municipal Bldg., waterworks, to Frazza Constr. Co., 62 East 15th St., Paterson, $114,921. Awarded in August. Noted Apr. 30.

N. J., Paterson—Passaic Valley Water Comn., 156 Ellison St., furnishing, installing hydraulic turbine generator equipment, work, incl. 3 fixed blade turbines, 600 kw. generator units and 1 automatically adjustable blade turbine, 600 kw. generator or unit, to Allis-Chalmers Mfg. Co., 50 Church St., New York, $94,600. Noted Aug. 13.

N. J., Wayne—Twp. Com., Town Hall, installing municipal water supply distribution system, incl. 12 mi. 6- to 14-in. pipe line, valves, hydrants, for Mountain View Sect., to Frazza Constr. Co., 62 15th St., Paterson, $114,921. Noted Aug. 19.

N. Y., Brooklyn—J. J. Dietz, comr. Water Supply, Gas and Electricity, Municipal Bldg., mains in Triton Ave., to Draganetti Constr. Co., 711 East 228th St., New York, $9,988. Noted Aug. 20.

N. Y., Long Island City—J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., New York, mains in 30th Ave., to Gregory Contg. Co., 351 East 124th St., New York, $5,253. Noted Aug. 26 Daily.

N. Y., St. George—J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., New York, mains in Adams St. to Ialenti Bros., Bay St., $13,900. Noted Aug. 26.

Okla., Okarche—J. C. Busche, city clk., watermains, tank on tower, to Humphreys & Thomas, Omaha, Neb., $44,000. Former contract rescinded. Noted June 4.

Pa., Jamestown—State Water Power and Resource Bd. of Harrisburg, Pynatuning Reservoir Dam to form lake 16.5 mi. long, 2 mi. wide, incl. 8,365,000,000 cu.ft. capacity, 370,000 cu.yd. embankment, 180,000 cu.yd. excav., 9,000 cu.yd. riprap, 5,000 cu.yd. concrete, 4,000 cu.yd. stone paving, 900 tons steel, to C. R. Cummings, Inc., Union Trust Bldg., Cleveland, O., rolled embankment, $339,567. Est. $1,500,000. Noted Aug. 20.

Pa., Pittsburgh—City, c/o E. G. Lang, dir. P. Wks., City Hall, piping for new Brilliant Pumping Station at Aspinwall, to J. W. Maglaughlin, Bulletin Bldg., $88,273. Noted May 21.

Ont., Westboro—Nepean Twp., Contr. H, installing 21,750 ft. c.i. watermains and 20,250 ft. sewers, to Ryan Constr. Co., Ltd., Toronto, $66,088; Contr. I, installing 18,200 lin.ft. c.i. watermains and 16,850 lin.ft. sewers, to Grant Bros. Constr. Co., Bank Nationale Bldg., Ottawa, $54,267; sewer pipe, to H. Hayley, Hurdmans Rd., Ottawa, $11,081; c.i. pipe, to Alexander Fleck, Ltd., 420 Wellington St., Ottawa, $30,288. Grand total $161,724.

SEWERS

PROPOSED WORK

Mich., Iron Mountain—Dickinson Co. rein.-con. box culvert sewer to enclose creek now serving as open drain, south of Kimberly Ave. incl. catch basins, inlets, connections. $150,000. W. Burgess, Iron Mountain, co. engr.

Utah, Salt Lake City—City, 4th South Street Storm Sewer Project. $360,000. H. Jessen, city engr.

Ont., Brantford—New sewers and extensions, $99,000; grading, widening streets, $28,000; concrete facing dyke, $10,000. A. Fairchild, city engr.

Ont., Eastview—Town Council, main sewer, $150,000. D. Langelier, mayor.

Ont., Hamilton—For 8 in. and up tile sewers in Concession St. $95,202. Work will probably be done by day labor soon. W. L. McFaul, City Hall, engr.

Ont., Ottawa—For 48 in. concrete sewer in York St. from Sussex St. to King Edward Ave. $100,000. F. C. Askwith, City Hall, engr.

Ont., Toronto—For 1½ mi. tile, concrete sewers in Keating St., Logan and Booth Aves. $114,700. R. C. Harris, City Hall, engr.

Que., Verdun—City discharge sewer, $390,000; trunk sewer, $131,000.

Ont., Woodstock—Sanitary sewers in Victoria, Huron, Dundas and Bain Sts., $30,000; storm sewers on Van Sittart Ave., York and Huron Sts., $11,520; concrete paving, $15,000. F. J. Ure, city engr.

BIDS ASKED

Calif., Los Angeles—See "Contracts Awarded."

Ky., Louisville—Sept. 29, by Commissioners of Sewerage, 400 Marion E. Taylor Bldg., Beargrass Creek Impvt., South Fork, Sect. J 1, Contr. 60. W. M. Caye, technical engr.; adv. E. N.-R. Sept. 17.

Md., Baltimore—Sept. 23, by Bd. Awards, sanitary sewers, drains, Sanitary Contr. 286, incl. 13,524 lin.ft. 8 in. vitr. sewer and drain, 3,643 lin.ft. 6 in. vitr. pipe house connections, 4,900 lin.ft. 4 and 6 in. underdrain, 509 vertical ft. standard manholes. M. J. Ruark, Municipal Bldg., sewerage engr.

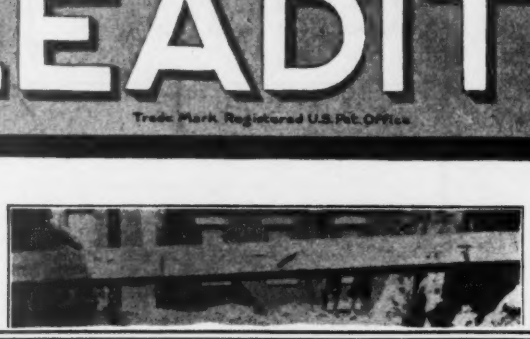
Mass., Boston—Sept. 18, by Dept. P. Wks., J. A. Rourke, comr., sewerage works in Baker St., West Roxbury. $25,000.

See proposed advertising on page 70

Constr. News page 107

LEADITE

Trade Mark Registered U.S. Pat. Office



For Tight, Permanent Water Main Joints

For more than a quarter of a century, LEADITE has been used for jointing bell and spigot Water Mains,—and rightly so. For LEADITE not only effects a SAVING in every respect, but offers that degree of TIGHTNESS, DEPENDABILITY and PERMANENCE so essential to good Water Main Construction.

Considering the fact that Water Mains are laid for permanency,—then covered up,—it seems only logical that their joints should be made with a time-tried and reliable material,—otherwise, the great expense of digging up streets (to say nothing of the inconvenience to water users) due to faulty joints, might readily occur.

The best evidence of the all-around effectiveness of LEADITE is probably summed up by the statement that:

Thousands of miles of bell and spigot water mains, all over this country and in many overseas countries—are successfully jointed with LEADITE.

The Pioneer Self-Caulking material for c. i. pipe.
Tested and used for over 30 years.
Saves at least 75%.

THE LEADITE COMPANY

Land Title Building Philadelphia, Pa.

No Caulking

Sewers (Continued)

N. Y., Long Island City—Sept. 22, by J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., New York, mains in Elwell Crescent, Huntley Dr., Union Turnpike, Lefferts, Queens, Nassau, Springfield Blvds., Jay, Penelope, Roosevelt, 31st, 46th, 59th, Elder Negundo 48th, 49th Aves., 20th, 41st, Carlton, 59th, 60th, 65th, 80th, 110th, 217th, 244th and 92nd Sts.

O., Cleveland—Sept. 25, by city, 3,227 ft. 8 x 12 ft. double-barrel concrete culvert, Nine Mile Creek, from St. Clair Ave. to East 152nd St. $350,000. R. Hoffman, City Hall, engr.

CONTRACTS AWARDED

Calif., Inglewood—Storm drain in Industrial Ave. between Edgewood St. and Ivy Ave., involving 1,683 lin.ft. 78 in. double med. rein.-con. pipe, incl. excav. and saddle, 195 lin.ft. 24 in. and 38 lin. ft. 12 in. double med. rein.-con. pipe, 16 ft. 8 in. Class B c.i. pipe, manholes, catch basins, paving, sidewalks, to J. Artukovich, 912 Atlantic Blvd., Haynes, $33,590.

Calif., Los Angeles—Los Angeles Co. Sewer Dist. 1, two sections Hooper Ave. Trunk Sewer between 119th St. and intersection of Harbor Ave. and Artesia Ave., incl. 15,500 lin.ft. 27- to 36-in. pipe; Los Angeles Co. Sewer Dist. 2, Artesia Trunk Sewer, incl. 1 mi. 8 in. pipe sewer connecting with sewerage system, to be constructed in Artesia Dist. South Bay Sanitation Dist., 1,000 lin.ft. 18 in. sewer in city of Redondo in The Esplanade from Sapphire St. to Ainsworth Court, day labor, under supervision of A. K. Warren, engr., Law Bldg. Noted Aug. 27.

Ky., Louisville—Commissioners of Sewerage, 400 Marion E. Taylor Bldg., Mill Creek Sewer, Contr. 58, incl. 6,874 lin.ft. 8 ft. 4 in. to 20 ft. 3 in. inverted egg rein.-con. sewer, overflow structure, junction chamber, manholes, 6,874 cu.yd. earth excav., 22,800 cu.yd. rein.-con. or plain concrete, 5,100,000 lb. steel reinforcing bars, to Arundel Corp., Pier 2 Pratt St., Baltimore, Md., $764,520. Noted Aug. 6.

Ky., Louisville—Commissioners of Sewerage, 400 Marion E. Taylor Bldg., Trevillian Way Trunk Sewer, Sect. A, 3,575 lin.ft. 7 ft. 6 in. x 7 ft. and 6 ft. x 7 ft. twin rectangular and 6 ft. 9 in. and 6 ft. 3 in. semi-elliptical rein.-con. sewers, outlet structure, diversion and chambers, manholes, 3,575 lin.ft. earth and 1,400 cu.yd. rock excav., 5,100 cu.yd. concrete, 935,000 lb. steel reinforcing bars, 1,100 sq.yd. vitr. brick invert lining, to J. B. McCrary Co., 1408 Citizens & Southern Bank Bldg., Atlanta, Ga., $147,238. Noted Aug. 13.

Mo., St. Louis—Bd. P. Serv., City Hall, Wherry Avenue Public Outlet Sewer, to Martin & Reilly, 7227 Lindell Blvd., $86,024. Est. $151,000. Noted Aug. 12.

O., Akron—A. B. Backherms, sewerage engr., 151,600 ft. 8 to 15 in. sanitary sewers, 440 six in house laterals, 1,000 ft. piling, 270 cu.yd. masonry in Linwood Ave., et al., to F. George, 1657 Mahoning Ave., Youngstown, $64,160. Est. $80,000. Noted Sept. 3.

Pa., Pittsburgh—See "Streets and Roads."

WASTE DISPOSAL

PROPOSED WORK

Que., Verdun—City incinerator, $150,000.

BRIDGES

PROPOSED WORK

Minn., Brainerd—State Hy. Comn., St. Paul, steel, concrete bridge over Mississippi River. $200,000.

BIDS ASKED

Michigan—Sept. 23, by H. W. Hagaman, div. engr., Saginaw, Br. 2 of 74-26-12, Contrs. 1 and 2, 2 rein.-con. abutments, semi-gravity type steel deck girder, rein.-con. flooring, concrete wearing surface, 22 ft. roadway, Sanilac and St. Clair Counties, for State Hy. Comn., Lansing.

New Jersey—Oct. 7, by State Hy. Dpt., Trenton, viaduct to carry Route 29, Sect. 1, across tracks Lehigh Valley R.R. and Liberty Ave., Hillside Twp., Union Co. A. L. Grover, ch. engr.; adv. E. N.-R. Sept. 17.

New York—A. Goldman, comr. Plant & Structures, Municipal Bldg., New York, bids about Oct. 1, raising tower piers, Triborough Bridge, 20 to 40 ft. and granite facing, $450,000—bids in December, erecting towers, steel, etc., $2,000,000—bids in spring, 22¼ in. cable, 8 reinforced arches and other work. Noted May 28.

N. Y., Hudson Falls—Oct. 5, by R. D. Hayes, comr. Canals & Waterways, Albany, bridge, approaches across Glens Falls feeder, at Main St., $39,500; Contr. M-74; fabricating, furnishing, delivering steel, counterweights and machinery, f.o.b. cars Hudson Falls, for bridge, at Maple St., $11,068, Contr. M-75; adv. E. N.-R. Sept. 17.

Ohio—Sept. 22, by O. W. Merrell, dir. hys., Columbus, 72 ft. span, steel beam bridge, 24 ft. roadway, Sect. "B" Baltimore-Reynoldsburg Rd., Fairfield Co., $19,874; extending, rebuilding several concrete bridges, Sect. "D" Napoleon-Waseon Rd., Henry Co., $8,393—widening 31 ft. span concrete beam bridge, from 19 to 34 ft., Sect. "I" Logan-Athens Rd., Hocking Co., $5,783—45 ft. span concrete beam bridge, Sect. "B" Dayton-Germantown Rd., Montgomery Co., $10,789—two 25 ft. span concrete slab bridge, and three 45 ft. span concrete beam bridge, Sect. "C" same road, $24,927—30 ft. span concrete beam bridge, Sect. "A" Findlay-Delphos Rd., Putnam Co., $6,929—20 ft. span concrete slab bridge culvert, Sect. "G-2" and "F-2" Bryan-Napoleon Rd., Williams Co., $4,808, all foregoing 24 ft. roadway—repairing, rebuilding concrete bridges, culverts Sects. "O" and others, Findlay-Tiffin, Fostoria-Carey, Bucyrus-Tiffin and Uper Sandusky-Bellvue Rds., Seneca Co., $14,216.

Ohio—Sept. 22, by State, O. W. Merrell, hy. dir., Columbus, rein.-con. bridge Broad Road of Cleveland-Akron Rd., Cleveland, $438,000. J. O. McWilliams, Western Reserve Bldg., Cleveland, div. engr.

Tex., Houston—Sept. 23, at office City Secretary, rein.-con. bridge over Brays Bayou, 75th St. J. M. Nagle, Houston, city engr. Noted Sept. 10.

Virginia—See "Streets and Roads."

CONTRACTS AWARDED

Maine—State Hy. Dpt., Augusta, rein.-con. bridge, Maine St., Camden, to W. V. Mitton, Inc., 12 Winter St., Augusta, $13,205—concrete bridge, Dixfield and Mexico, to H. J. Cyr Co., 65 Temple St., Waterville, $12,289—Franklin St. Bridge, Bangor, to Cyr Bros Co., Main St., Waterville, $29,747; bridges, Lyman, to B. Benedetto Bucci, 117 Newbury St., Portland, $2,533—in Monmouth, to Kennebeck Constr. Co., 173 Main St., Waterville, $12,079—Canal Bridge, Madison, and Marsh Bridge, Southwest Harbor and Tremont, to Green & Wilson, 76 Main St., Waterville, $19,700 and $7,652, respectively—Flood Bridge, Topsfield, to Jas. Frederick & Co., Pittsfield, $6,213. Grand total, $103,418. Noted Aug. 27.

Missouri—State Hy. Dpt., Jefferson City, to M. E. Gillioz, Monett, bridges over Dodge Hollow, $7,678; over Crane Creek, $12,348, both Stone Co.—to G. Knutson, 3520 Main St., Kansas City, over Otter Creek, $18,919; over West Fork Salt River, $33,285; over Little Indian Creek, $4,735; over branch, $3,581; over Indiana Creek, $10,474; over drain, $1,703; all in Monroe Co.—to G. W. Condon, 233 Grain Exch. Bldg., Kansas City, over Wild Cat Creek, $10,643; over Little Creek, $3,366; over Wabash R.R. tracks $8,267; over creek, $726; all Nodaway Co.—to G. E. Stoner, Charleston, over Spring Creek, $22,287; over North Fork, $30,024, both Douglas Co.—to W. D. Knoll, Lowry City, over Creek, $468; over Spring Branch, $567, both Henry Co.—to Neyer Constr. Co., Billings, over Lick Creek, Ozark Co., $19,235—to H. H. Ruddell, Springfield, over Wolf Creek, Wright Co., $5,502 — to Whipple & Irwin, Springfield, over Drainage Ditch, Dunklin Co., $2,409—to R. B. Potostnick, Cape Girardeau, over Lateral 1, Dist. 15, Scott Co., $4,499. Grand total, $200,716. Noted Aug. 20.

Mo., St. Louis—City, Bd. P. Serv., City Hall, erecting, painting 7,000 tons structural steel for East St. Louis Union Station approach to St. Louis Municipal Bridge across Mississippi River between St. Louis, Mo., and East St. Louis, Ill., to Ben Hur Erection Co., 5100 Farlin Ave., $131,250. Noted July 30.

Pennsylvania—See "Streets and Roads."

Pa., Phila. — Philadlephia & Reading R. R. Co., Reading Terminal, C. Dillenbeck, ch. engr., 200 tons steel for bridge at Logan St., to American Bridge Co., 71 Bway, New York.

Pa., Pittsburgh—R. G. Woodside, controller Allegheny Co., Court House, South Approach to West End North Side Bridge, Bridge 3 over Ohio River, to R. H. Cunningham & Sons Co., 125 Grant Ave., Turtle Creek, $731,588. Est. $1,070,000. Noted Aug. 13.

Pa., Pittsburgh—See "Streets and Roads."

Wash., Seattle—Northern Pacific Ry. Co., B. Blum, ch. engr., St. Paul, Minn., found. work for 1,000 ft. steel bascule type bridge over Duwamish River, Spokane Ave., to General Constr. Co., Colman Bldg., structural Steel, to Wallace Bridge & Structural Steel Co., West Marginal and Idaho Sts. Est. $325,000. Noted Nov. 27.

Ont., Westboro—See "Waterworks."

STREETS AND ROADS

BIDS ASKED

California—Sept. 23, by C. H. Purcell, engr. State Hy. Comn., Sacramento, grading, concrete paving 5.5 mi. road between Pajaro River and southerly boundary, San Benito Co. C. H. Purcell, hy. engr.

Calif., Fairfax—Sept. 22, by L. A. Grosbauer, city clk., grading, asphaltic concrete paving Impvt. Dist. 1, San Rafael-Olema Rd. To exceed $25,000.

Calif., Los Angeles—Sept. 28, by Bd. Supervs. Los Angeles Co., grading, curbing, sidewalks, 9-7-7-9 in. concrete paving 540,000 sq.ft., 3 in. asphaltic concrete paving 545,000 sq.ft., 6 in. asphaltic concrete paving 145,000 sq.ft. Pomona Blvd.

Connecticut—Sept. 21, by J. A. Macdonald, state hy. comr., Hartford, rein.-con. paving 1,829 ft. hy. Danbury, Monroe, New Milford, Ridgefield and Wilton—bituminous macadam paving 5,495 ft. Ansonia—waterbound macadam paving 14,230 ft. Woodbridge—unrolled macadam paving 14,000 ft. Haddam—gravel surfacing 6,912 ft. Montville—20,200 ft. Newtown—18,555 ft. North Canaan—25,540 ft. Sharon—loose gravel surfacing 1,300 ft. Norwich—21,845 ft. Willington; adv. E. N.-R. Sept. 17.

Georgia—Sept. 22, by State Hy. Dpt., J. W. Barnett, hy. engr., East Point, paving, 3 bridges 7.785 mi. Statesboro-Savannah Rd., Bulloch Co.—paving, 1 bridge 5.7 mi. Cedartown-Atlanta Rd., Polk Co.—paving 4.765 mi. Thomasville-Moultrie Rd., Colquitt Co.—4.51 mi. and 6.773 mi. Quitman-Moultrie Rd., Brooks Co.—paving, widening 1 bridge, 5.362 mi. Avondale-Covington Rd., DeKalb Co.—grading, 1 bridge 10.587 mi. Ellaville-Butler Rd., Taylor Co. $725,000.

Idaho—Sept. 22, by A. Harbour, comr. P. Wks., Boise, grading, drainage, crushed rock surfacing 1.894 mi. and crushed rock resurfacing 7.049 mi. Buhl-Clover Hy. between Buhl and Clover, Twin Falls Co.

Ind., Crown Point—Sept. 28, by Bd. Comrs. Lake Co., W. E. Whitaker, aud., grading, drainage structures, concrete surfacing Anna A. Dickey Rd., et al, Center Twp. $110,000.

Ind., Woodruff Place—Sept. 21, by Bd. Town Trustees, J. M. Dils, clk., widening, resurfacing East Michigan St., between west and east boundaries of town. $25,000.

Ia., Carroll—Sept. 21, at office Auditor Carroll Co., gravel surfacing 15 mi. local roads. J. F. Maher, Carroll, co. engr.

Ia., Oskaloosa—See "Bridges."

Ia., Primghar—Sept. 21, at office Auditor O'Brien Co., gravel surfacing 5 mi. trunk and 12 mi. local roads. W. L. Anderson, Primghar, co. engr.

Ia., Sioux City—Sept. 25, by E. V. Moone, city clk., concrete paving Jones and Douglas St., from 34th to 35th Sts.—Silver St., from 14th to 17th Sts.—Turner St., from Villa Ave. to West 6th St.—grading, paving alley block surrounded by 8th, 9th, Nebraska and Jackson Sts. L. Hintgen, City Hall, engr.

Ia., Waterloo—Sept. 21, at office Auditor Black Hawk Co., crushed rock or gravel surfacing 8 mi. trunk road. Address County Engineer or Auditor, Waterloo.

Kan., Kansas City—Sept. 28, by W. Beggs, clk., Wyandotte Co., grading, concrete paving, earth shoulders from present paving south to State Hy. 32. O. K. Williamson, Court House, engr.

Kentucky—Sept. 25, by State Hy. Dpt., Frankfort, (**S.A.P. means State Aid Project**), grading, drainage structures 7.17 mi. Walton-Verona Rd., 20 and 26 ft., S.A.P. 157-AG Boone Co.—2.704 mi. Lebanon Junction-Boston Rd., S.A.P. 46-DG—7.844 mi. Belmont-Wooldridge Ferry Rd., S.A.P. 145-AG, both Bullitt Co.—9.98 mi. Lebanon-Raywick Rd., S.A.P. 210-AG Marion Co.—5.611 mi. West Liberty-Sandy Hook Rd., F.R., 59-AG, Morgan Co.—8.465 mi. Taylorsville-Mt. Washington Rd., S.A.P. 46-AG Spencer Co.—all foregoing 24 and 30 ft. wide—traffic bound limestone, crushed limestone, waterbound macadam, traffic bound river gravel or river gravel surfacing 4.793 mi. Princeton-Gracey Rd., 18 ft., S.A.P. 280-AS Caldwell Co. H. D. Palmore, ch. engr.

Maryland—Sept. 22, by State Roads Comn., Baltimore, G. O. Uhl, chn., concrete paving 1 mi. Contr. M-111-52 Montgomery Co.—0.38 mi. Contr. T-40-211 Talbot Co.—macadam paving 2.01 mi. Contr. M-177-34, Montgomery Co.—1 mi. Contr. W-96-62, Washington Co.—concrete shoulders 0.98 mi. Contr. M-184-311, Montgomery Co.; adv. E. N.-R. Sept. 17.

Massachusetts—Sept. 22, by Dpt. P. Wks., A. W. Dean, engr., State House, Boston, bituminous macadam paving 4,581 ft. Forest St., and 11,582 ft. Beach Rd., both Salisbury—3,846 ft. Avon—3,567 ft. Rowley—gravel and tar surfacing 2,950 ft. Plainfield.

Mass., Boston—Sept. 21, by Dpt. P. Wks., J. A. Rourke, comr., sheet asphalt or bitulithic paving Searle Rd., Pender St., Ward 20. $25,000.

Mass., Boston—Sept. 22, by Dpt. P. Wks., J. A. Rourke, comr., sheet asphalt or bitulithic paving Park St., Ward 20. $35,000.

Mass., Boston—Sept. 23, by Dpt. P. Wks., J. A. Rourke, comr., sheet asphalt or bitulithic paving, edgestones, artificial stone sidewalks, Sydney St., Ward 13. $25,000 or more.

Michigan—Sept. 18, by H. G. Oakes, div. engr., Plymouth, shaping, concrete paving 0.605 mi. Assessment Dist. Rd. 463-C-2, approaches to Huron River and Silver Creek Bridge, Monroe and Wayne Counties, for State Hy. Dpt., Lansing.

Minn., Grand Marais—J. E. Smith, engr. St. Louis Co., bids about later part October, improving Hy. 1 between Lutsen and Grand Marais.

New York—Oct. 6, by A. W. Brandt, comr. Hys. Albany, constructing hys. in Albany, Dutchess, Putnam, Franklin, St. Lawrence, Herkimer, Orleans and Sullivan Counties—reconstructing hys. Delaware, Rensselaer and Westchester Counties—constructing storehouses at Cobleskill, Schoharie Co.—Warsaw, Wyoming Co. and Malone, Franklin Co.—heating and plumbing in store house, Waterford, Saratoga Co.; adv. E. N.-R. Sept. 17.

N. Y., Brooklyn—Sept. 23, by H. Hesterberg, pres. Brooklyn Boro, Boro Hall, granite on 6 in. concrete paving Metropolitan Ave., grading, asphalt on 6 in. concrete repaving Bway. and St. Felix St.

N. Y., New York—Sept. 22, by H. Bruckner, pres. Bronx Boro, Crotona Park, 3rd and Tremont Aves., sheet asphalt on concrete paving Fuller St., Bussing and Valentine Aves.—grading, curbing, sidewalks West Mosholu Parkway, White Plains Rd., Van Nest, Leland, Morrison Aves., East 156th and Chestnut Sts.—sewers in Cruger Ave. and Bartholdi St.

N. Y., New York—Sept. 23, by S. Levy, pres. Manhattan Boro, Municipal Bldg., grading, granite block on concrete paving Park Pl., 1st Ave., 60th, 23rd and Hudson Sts.; grading, sheet asphalt concrete paving Liberty and Exchanges Pls., Liberty and Canal Sts.

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Streets and Roads (Continued)

N. Y., Troy—Sept. 25, by Bd. Contr. & Supply, City Hall, paving Winter St. C. F. Morris, city engr.

Ohio—Sept. 22, by O. W. Merrell, dir. hys. Columbus, concrete, tar, macadam, bituminous macadam or brick, incl. furnishing and delivering brick paving 13,694 mi. hys. Ashland, Defiance, Erie, Franklin, Hocking, Holmes, Licking, Lucas, Montgomery, Muskingum, Trumbull and Williams Counties. $362,674.

Pennsylvania—Sept. 25, by State Hy. Dpt., Harrisburg, improving 32 mi. roads and 1 bridge in Allegheny, Blair, Clearfield, Crawford, Erie, Greene, Lackawanna, Lycoming and Montgomery Counties. S. S. Lewis, secy.; adv. E. N.-R. Sept. 17.

Tennessee—Sept. 25, by State Dpt. Hys. & P. Wks., Nashville, grading, drainage structures 0.773 mi. approaches to bridge over Caney Fork River between Carthage and Elmwood, Federal Aid Project 229-A, Smith Co.; 0.402 mi. approaches to bridge over Watauga River between Johnson City and Bluff City, Federal Aid Project 224-D, Washington Co. R. H. Baker, hy. engr.

Utah, Springville—Sept. 25, by City Council, curbing, guttering, concrete widening, 3,690 ft. present pavement Main St. $40,000. Caldwell & Richards, Salt Lake City, engrs.

Virginia—Sept. 22, by State Hy. Comn., Richmond, clearing, grubbing, drainage structures, grading 40,056 cu.yd. Route 22, Project S-479-F Craig Co.—clearing, grubbing, grading, drainage structures, concrete surfacing 30,281 sq.yd. Route 503, Project S-562-C Nansemond Co.—one 50 ft., one 55 ft. and one 47 ft. steel beam bridges, 2 over Tinkers Creek, 1 over Carvins Creek, near Troutville, Route 33, Project F-640-B Botetourt and Roanoke Counties—three 35 ft. rein.-con. beam span bridge over David Creek, near Caskie, Route 13, Project F-658-B5 Appomattox Co. H. G. Shirley, hy. engr.

Ont., Hamilton—See "Contracts Awarded."

Ont., Pembroke—See "Contracts Awarded."

CONTRACTS AWARDED

Calif., Redondo Beach—City Council, grading, curbing, sidewalks, 6 in. asphaltic concrete paving Elena Ave., to Griffith Co., Railway Bldg., Los Angeles, $84,510. Noted Aug. 27.

Iowa—State Hy. Comn. Ames, to Highway Constr. Co., Des Moines, grading, drainage structures, paving 0.354 mi. road in Benton Co. $8,090, 0.275 mi. Boone Co. $6,580, 0.322 mi. Hardin Co. $7,654; 0.324 mi. Poweshiek Co. $13,326—to Bryant Paving Co., Waterloo, 0.488 mi. Black Hawk Co. $14,313—to Snyder & Johnson, Humboldt, grading, drainage structures 0.527 mi. Madison Co. $4,262—to Interstate Constr. Co., Madison, Wis., gravel surfacing 11 mi. Clayton Co. $7,722—to Myron & Baker, Olin, 0.63 mi. Clayton Co. $1,774; 0.61 mi. Delaware Co. $1,342—to Larimer & Shaffer, Cedar Rapids, 0.01 mi. Delaware Co. $1,345—to Kriege Constr. Co., Marshalltown, 8.4 mi. Mills Co. $7,031—to L. J. Peters, 3400 Carlisle Rd., Des Moines, 7.3 mi. Ringgold Co. $18,469—to Standard Oil Co. of Indiana, 137 West 11th St., Indianapolis, Ind., 95,000 gal. road oil, $3,470. Grand total, $95,378. To Armstrong Paving Products Co., 306 Crocker Bldg., Des Moines, heating and applying 96,500 gal. road oil, f.o.b various stations in state at $0.0125 per gal. Noted Aug. 27.

Kan., Topeka—City Council, F. W. Knapp, city clk., grading, curbing, guttering, sidewalks sodding, moving fire alarm cable, installing traffic signs, 11 blocks West 10th St., from Morris to Polk Sts., also sewer for new Topeka High School, to Kirkham & Kilmer, 1460 Pembroke Lane, $47,512; alphalt surfacing, to Kaw Paving Co., 100 Topeka St., $9,862.

La., Bunkie—Concrete curbing, surface treating streets, to B. J. Carbo, Alexandria, $30,000; concrete paving, storm drainage, to E. E. Rabalais & Son, Bunkie, $20,000.

Maine—State Hy. Dpt., Augusta, gravel surfacing 2.49 mi. hy. Waterboro and bituminous macadam paving 0.76 mi. Solon, to W. H. Hinman, Skowhegan, $17,042 and $16,831 respectively—gravel surfacing 2.68 mi. Parkman, to Wyman & Simpson, 284 Water St., Augusta, $24,970. Grand total $58,843. Noted Aug. 27.

Maryland—State Roads Comn. G. C. Uhl, chn., Baltimore, gravel surfacing 1.02 mi. Contr. Sm-84-82, St. Mary's Co., to Pembroke & Gasparovic, Park Hall, $7,471. Noted May 28.

Maryland—State Roads Comn., G. C. Uhl, chn., Baltimore, gravel surfacing 1.9 mi. Contr. Ce51-82 Calvert Co., to T. Mullan, 3945 Greenmount Ave., Baltimore, $15,636. Noted July 9.

Maryland—State Roads Comn., Baltimore, G. C. Uhl, chn., concrete shoulders 2.5 mi. Contr. P-186-311, Prince George Co., to G. B. Mullin Co., 1296 Upshur St. N.W., Wash., D.C. $21,214. Noted Aug. 13.

Maryland—State Roads Comn., G. C. Uhl, chn., Baltimore, concrete paving 1.5 mi. Contr. Ce-117-22, Cecil Co., to Phillips Bros., Salisbury, $23,406; substructure for bridge over Deer Creek and macadam paving 6.14 mi. Contr. H-124-44, Hartford Co., to T. B. Gatch & Sons Building & Contg. Corp., Bel Air Rd., Raspeburg, Baltimore, $112,713. Noted Sept. 3.

Minn., St. Paul—C. A. Carlson, city purch. agt., grading, paving East 9th St., to Feyen Constr. Co., 277 Burgess St., $24,960.

Missouri—State Hys. Dpt., Jefferson City, to W. D. Knoll, Lowry City chats surfacing 3.712 mi. Henry Co. $14,198; 2.645 mi. Henry Co. $10,926 graveling 4.26 mi. Monroe Co., $3,652; 4.603 mi. Monroe Co. $3,749—to Nyer Constr. Co., Billings, 0.441 mi. Ozark Co., $8,020; 1.641 mi. Miller Co. $32,823; 0.91 mi. Ozark Co. $14,226; 3.543 mi. Miller Co. $37,664—to R. B. Potostnick, Cape Girardeau, 4.164 mi. Jefferson Co. $22,401; 3.92 mi. Scott Co. $16,703; 3.439 mi. Jefferson Co. $3,402—to O. E. Scarlett, Warsaw, 3.561 mi. Monroe Co. $2,811; 2.548 mi. Ralls Co. $1,294; 5 mi. Monroe Co. $3,977—to R. H. Sharp, Rudd Springs, 0.221 mi. Stone Co. $4,033—to Chaney & Amyx, Branson, 0.703 mi. Texas Co. $5,787—to G. E. Stoner, Charleston, 4.399 mi. Douglas Co. $51,043—to M. E. Gillioz, Monett, 0.318 mi. Stone Co. $7,046—to H. H. Ruddell, Springfield, 4.913 mi. Wright Co. $32,249—to G. Knutson, 3520 Main St., Kansas City, 0.51 mi. Monroe Co. $3,859; grading 0.431 mi. Monroe Co. $10,183; 3.963 mi. Monroe Co. $21,088; 4.47 mi. Monroe Co. $20,164; 4.539 mi. Monroe Co. $25,739; 3.662 mi. Monroe Co. $28,955—to G. W. Condon, 223 Grain Exch. Bldg., Omaha, Neb., 4.358 mi. Nodaway Co. $31,713; 3.77 mi. Nodaway Co. $17,422; 3.247 mi. Gentry Co. $18,376—to 0.12 mi. Nodaway Co. $2,778. Grand total $456,281. Noted Aug. 20.

Nebraska—Dpt. P. Wks., Lincoln, to Booth & Olson, Inc., Sioux City, Ia., paving 7.5 mi. Dakota Co. $168,270—to A. N. Eaton Metal Products Co., 1301 Willis St., Omaha, culvert pipe same project $260; culvert pipe Box Butte and Dawes Counties $748; road and driveway pipe, Loup Co. $2,861; Cherry Co. $1,353; Otoe Co. $1,013; Saunders Co. $3,045; Harlan Co. $1,583—to Central Bridge & Constr. Co., Wahoo, three 75 ft. deck girder steel span bridges Dakota Co. $35,278; oil-sand surfacing 4.5 mi. Grant Co. $18,414—to Moran Constr. Co., 2915 North 16th St., Omaha, grading 11.5 mi. Johnson Co. $43,347—to G. E. Smith, 525 South 13th St., Lincoln, culverts in Johnson Co. $28,586—to Beatrice Steel Tank Co., Beatrice, roadway and driveway pipe, Johnson Co. $2,260—to Artificial Stone Co., Bruning, bridges same county, $4,270—to C. H. Bacus, Litchfield, culverts in Box Butte and Dawes Counties $240—to Roberts Constr. Co., 404 1st Natl. Bldg., Lincoln, graveling 3.1 mi. Hooker Co. $6,567—to J. E. Tifft, Omaha, grading 11.3 mi. Loup Co. $41,840; 10 mi. Antelope Co. $7,554—to Yant Constr. Co., 1146 Omaha Natl. Bank Bldg., Omaha, grading 14 mi. Cass Co. $20,176; graveling 19 mi. Saunders Co. $12,879—to Abel Constr. Co., 308 Terminal Bldg., Lincoln, graveling 14 mi. Cass Co. $10,918; 1.7 mi. Cass Co. $714; 13 mi. Custer Co. $4,645—to G. W. England & Son, Murdo, S. D., grading 11.4 mi. Cherry Co. $23,632—to M. F. Morrissey Chadron, culverts, concrete work, Cherry Co. $6,378—to Keim Constr. Co., Tecumseh, culverts Cass Co. $4,344; in Saunders Co. $2,607; Cuming Co. $2,335—to Western Bridge & Constr. Co., 3867 Leavenworth St., Omaha, sand graveling 20.4 mi. Antelope and Holt Counties, $4,109; 16.3 mi. Cuming Co. $14,325; 6.4 mi. Holt Co. $5,492; graveling 8 mi. Otoe Co. $8,976; 18 mi. Knox Co. $12,884; 7 mi. Harlan Co. $8,015; 10 mi. Pawnee Co. $8,589; 11 mi. Gage Co. $5,594; 8 mi. same county $3,398; 1.1 mi. Red Willow Co. $623—to E. W. Nichols, Fairmont, sand graveling 20.4 mi. Fillmore Co. $10,455; 14.9 mi. Thayer Co. $4,597; 22 mi. Sherman and County Counties, $10,464; 17.8 mi. Custer Co. $8,376; 10.7 mi. same county $4,087; 11.7 mi. same county $4,036—to A. I. Cram, Burwell, graveling 13 mi. Nance and Boone Counties $9,760; 8.6 mi. Custer Co. $3,746—to D. Quinton, Kearney, culverts, roadway pipe, Custer Co. $995; Antelope Co. $470—to Koehler Constr. Co., Sterling, sand graveling 10 mi. Nuckolls Co. $5,674; graveling 14.1 mi. Platte and Colfax Counties, $14,171; sand graveling same counties $4,589; 4 mi. Jefferson Co. $1,790—to Mid State Constr. Co., Hastings, grading, culverts, roadway and driveway culverts, bridge on 12 mi. Franklin Co. $35,850—to Weidner & King, Lincoln, grading 16.3 mi. Cuming Co. $11,135—to Nebraska Culvert Mfg. Co., Wahoo, roadway pipe, Cuming Co. $2,326—to Monarch Eng. Co., Falls City, grading 8 mi. Otoe Co. $13,542—to Capitol Bridge Co., 1000 North 9th St., Lincoln, bridge Otoe Co., $2,123—to J. Nosky, Omaha, culverts Otoe Co. $4,628—to Blue Valley Sand & Gravel Co., Fairbury, sand graveling 12 mi. Jefferson City, $6,595—to J. F. Bowen, Omaha, 13.3 mi. Hayes Co. $10,623—to C. W. Smith, Plainview, 11.5 mi. Pierce Co. $2,528—to Murphy Gravel Co., Fremont, 10.4 mi. Burt Co., $4,995—to Carstenson and Co., Columbus, grading 7.1 mi. Boyd Co. $2,655. Grand total $720,008.

New Jersey—State Hy. Comn., Trenton, grading, 9 in. rein.-con. paaving 6.471 mi. Camden and Burlington Counties, to Riverside Concrete Co., Riverside. $560,163. Noted Aug. 13.

N. J., Newton—Bd. Freeholders, Sussex Co., Court House, grading, rein.-con. paving Mill St. to S. B. Martin, Sussex. Est. $25,000. Noted Aug. 20.

N. J., Roselle—Mayor and boro Council, asphalt paving 10th Ave., Williams and Clark Sts., to L. DiFrancisco, Inc., Westfield, $20,689.

New Mexico—Pub. Rds., Denver, Colo., grading 1.894 mi. Cedro Canyon Forest Project, Bernalello Co., to Armstrong & Armstrong, Roswell, $52,923.

N. Y., Long Island City—G. U. Harvey, pres. Queens Boro, Queens Subway Bldg., to J. C. Pescia, sewer in 43rd St. $852; Maase St. $1,389, 201st St. $1,332; to Matarazzo & Yondola, 1163 61st St., Brooklyn, 63rd St. $25,914, 91 2nd St. $8,094; to V. Clemente, 1193 Spofford Ave., New York, 68th St. $559 to P. Ambrosio, 674 Glenmore Ave., Brooklyn, Sybilla St. $2,404; to J. Deliso, 63rd Pl. $4,912; to A. Capasso, 865 Liberty Ave., Brooklyn, Maline St. $3,760, 90th Ave. $12,389, Hillside Ave. $15,135 to J. Scocozza, 1941 Cropsey Ave., 99th Ave. $6,993, 119th Ave. $13,757 to E. Meluccio, 1209 61st St., Brooklyn, 116th St. $8,336; to Belfatto Constr. Co., Foch Blvd., South Ozone Park, 143rd St. $2,003; to S. Guerriero, 1024 66th St., Brooklyn, 144th St. $2,509; to R. Tomassetti, 1074 60th St., Lakeview Pl. $12,671 to Mannino & Pittari, 283 86th St., Brooklyn, Westgate Lane $18,479 to C. Soverio, 87th St. $1,243. Grand total $142,725. Noted Aug. 12.

N. Y., New York—H. Bruckner, pres. Bronx Boro, Crotona Park, 3rd and Tremont Aves., to C. D. Beckwith, Inc., Seneca Ave. and Edgewater Rd., asphalt paving Waring Ave. $10,709 Bolton St. $8,287; St. Raymond Ave. $9,748 Colden Ave. $12,857 — to A. Musumecci, 277 East 146th St., regulating Cross Ave. $2,649 sewer in Olinville Ave. $3,134—to A. Compobosso, 1733 Davidson Ave., regulating Roberts Ave. $1,836. Grand total $49,220. Noted Aug. 26 Daily.

N. Y., New York—S. Levy, pres. Manhattan Boro, Municipal Bldg., Municipal Bldg., granite repaving 91st and asphalt block paving East 70th St., to E. T. Barry, 126-06 139th Ave., Laurelton, $16,660 and $12,786 respectively—sheet asphalt paving Bway., to C. D. Beckwith Co., Inc., Seneca Ave. and Edgewater Rd. $3,070—East 110th St., to Meehan Paving Co., 90 West St., $9,398. Grand total $41,914 Noted Aug. 20.

N. Y., New York—S. Levy, pres. Manhattan Boro, Municipal Bldg., to Premier Constr. Co., 367 Fulton St., asphalt paving Mott St. $88,973; East 15th St. $13,312; West 13th St. $24,512. Grand total $126,797. Noted June 18.

Oklahoma—State Hy. Dpt., Oklahoma City, paving 10.5 mi. Muskogee Co., to Ellis & Lewis, Surety Bldg., Muskogee $103,506—7.7 mi. Seminole Co., to Hyde Constr. Co., Enid, $108,513—11.19 mi. Pottatomie Co., to S. O. Maxey & Son, Durant, $143,199—6.9 mi. State Hy. 11, Kay Co., to Highway Constr. Co., Daniel Bldg., Tulsa, $92,813—grading, drainage structures 8 mi. Beckham Co., to Mervelt, Lawson & Scott, El Reno, $24,863—bridge on State Hy. 18 south of Pawnee, to Grant Williams, Oklahoma City, $9,338. Grand total $482,232.

Pennsylvania—State Hy. Dpt., Harrisburg, grading, drainage structures concrete surfacing 43,600 sq.yd., waterbound macadam surfacing 20,100 sq.yd. Route 129, Sect. 1, Dauphin Co., to Keystone Paving Co., Inc., Harrisburg, $146,481. Noted Aug. 20.

Pennsylvania—State Hy. Dpt., Harrisburg, grading, drainage structures, concrete surfacing 59,800 sq.yd. Route 131, Sect. 1, Chester Co., to L. Dolente, 5122 Master St., Phila., $162,485. Noted July 30.

Pa., Phila.—Bureau Hys., Dpt. P. Wks., City Hall Annex, A. Murdock, dir., to T. P. Lee, 5629 Cherry St., grading Albertson, Bartram, Brunswick, Grovers, Guyer, Suffolk, 79th, 80th, 85th and 86th Sts. $14,774; 300 ft. 63rd St. $18,505—to M. Masse, 3936 North Reese St., Aldine St. from Dungan to Whitaker Sts. and St. Vincent St. from Algon to Summerdale Sts. $817—to F. Feraco, 3632 North Lawrence St., Hartel St. from Verree to Watson Sts. $756—to Barber Asphalt Co., Hunting Park Ave. at E St., asphalt paving (assessment work) Ella St. from Wyoming to Mentor Sts. $2,261; Foulkrod St. from Howland to Montour Sts. $1,922; Uber St. from Rockland to Ruscomb Sts. $3,612 — to Eastern Asphalt Co., Pennsylvania Bldg., McCallum St. from Carpenter St. to point 216 ft. of Mt. Airy St. $23,846; 20th St. from Olney to Thorps Lane $4,730; country road improving Hartel St. from Verree to Watson Sts. $7,867; asphalt repaving Marshall St. from Vine to Spring Garden Sts., $13,509; 36th St. from Woodland to Spruce Sts. $3,137; 47th St. from Woodland to Grays Ferry Ave. $10,561; redressed granite block repaving Front St. from Mifflin to Moore Sts. $6,350—to Union Paving Co., Broad and Stiles Sts., asphalt paving (assessment work) Rising Sun Ave. from Bristol St. to Winghocking Ave. $15,341; country road improving Lawton St. from Medary to Chelton Sts. $2,047; asphalt repaving track area 19th St. from Tasker to Wharton Sts. $6,832—to Acchione Constr. Co., 1607 North Kean St., country road improving Aldine St. from Dungan to Whitaker Sts., $1,933; Conrad St. from Rockwell to Rhawn Sts. $1,713—to Atlas Paving Co., 317 South 6th St., Brunswick St. from 84th to 87th Sts., Dickens St. from 76th to 77th Sts. Guyer St. from 86th to 87th Sts., Suffolk St. from 84th to 86th Sts., 79th St. from Buist to Dickens Sts., 85th St. from Dickens to Grover Sts., 86th St. from Lyons to Guyer Sts. $10,721—to Martin Constr. Co., Germantown Ave. and Durham St., Shelborne St. from Tyson St. to point 235 ft. north, $1,199 — to Kaufman Constr. Co., 26 South 15th St., granite repairs to Bustletown Ave. Bridge over Pennypack Creek and Krewston Road Bridge over Pennypack Creek, $2,280. Grand total $154,803. Noted Aug. 20.

Pa., Pittsburgh—E. G. Lang, city dir., City-County Bldg., grading, curbing, paving Wilkesboro Ave. from Trenton Ave., southwardly, to Bituminous Paving & Resurfacing Co., 5638 Rippey St., $8,817—Haslage St. near Wilt, to D. Pavia, 331 Ladson St. $5,990—Pennsylvania Ave. from Barbeau to Water Sts. and Snow Way from Hampton to Bryan Sts., to M. O'Herron Co., South 1st and McKean Sts., $18,117 and $7,541, respectively—Chess St. from Simms St. south, to E. Burke, 6731 Burchfield St. $9,991—Grassmere St. from Oakwood Rd. to Glendon St., to Parkview Constr. Co., Boquet St., $12,787—blockstone resurfacing Pennsylvania Ave. from 18th St. eastwardly, to P. Healy, 42 Grape St., $1,470—foot bridge over Pennsylvania and West Virginia R.R. at Castor St., to Safety Guard & Mfg. Co., 823 Pennsylvania Ave., N.S. $4,097—iron fence on Forbes St., to Fort Pitt Malleable Iron Co., McKees Rocks $12,970—curb guards and other works on South 22nd Street Bridge to W. S.

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Streets and Roads (Continued)

Rue, Oliver Bldg. $5,488—retaining wall. On Hawk Way, to T. D'Angelico, 140 Cape May Ave., $934—sewer in Carey Way, to LeDonne & Casperm, 7305 Frankstown Ave. $1,264—sewer in Bigelow Blvd., near Center Ave., to F. Manella, 1507 North Lang St. $926. Grand total, $90,392.

South Carolina—State Hy. Comn., Jefferson Hotel, Columbia, to Ballenger Paving Co., Greenville, concrete paving hy. Darlington Co., $201,580; Marlboro Co., $160,547; Newberry Co., $193,734—to Cornell-Young Co., Macon, Ga., 13.706 mi. Orengeburg-Bamberg Counties, $172,380; 15.444 mi. Chesterfield Co., $181,598—to R. G. Lassiter & Co., Columbia, 15.203 mi. Laurens Co., $241,387—to Claussen-Lawrence Constr. Co., 1394 Gwinnett St., Augusta, Ga., 14.619 mi. Abbeville Co., $177,642—to Harrison Eng. & Constr. Corp., 506 Mutual Bldg., Kansas City, Mo., 20.555 mi. Spartanburg and Greenville Counties, $266,635—to Henry Constr. Co., Greenville, 16.526 mi. Chester Co., $83,166—to T. B. Gillespie, Inc., Palatka, Fla., bituminous surfacing 20.407 mi. Barnwell Co., $109,774—to C. G. Fuller, Barnwell, 24.996 mi. Edgefield, Saluda and Newberry Counties, $116,521—to Carolina Road Surfacing Co., Greenville, 25.32 mi. Allendale and Hampton Counties, $172,086—to R. B. Tyler Co., Columbia, 4.885 mi. Oconee Co., $14,094; 5.573 mi. Greenville and Anderson Counties, $13,467—to R. G. Kennedy, Batesburg, building earth type road, Flood Relief Project 22, Aiken Co., $1,881—to A. H. Singer, LaFayette, Ala., 15.026 mi. McCormick Co., $72,613—to Consolidated Paving Co., Columbia, 7.653 mi. Dillon Co., $43,437—to C. M. Lyle Constr. Co., Gainesville, Ga., 9.706 mi. Aiken Co., $38,651—to Hooks & Mendenhall, Charlotte, N. C., building bridge, Orangeburg Co., $6,703—to J. S. Bowers, Whiteville, N. C., bridge work, Barnwell Co., $8,597—to George A. Thomason & Co., Greenwood, bridge work, Laurens Co., $16,217; Laurens and Union Counties, $44,948—to C. T. Felix, Columbia, bridge construction, Colleton Co., $5,329—to W. J. Tidwell, Jr., Abbeville, bridge work, Chester and Lancaster Counties, $20,605—to J. B. Britton, Sumter, bridge work, Florence Co., $7,589—to Austin Bros. Bridge Co., 1195 Mickleberry St., S. W., Atlanta, Ga., bridge construction, Florence Co., $52,438—to B. F. Ramseur, Blacksburg, bridge construction, Greenwood Co., $9,710—to Dewey Bros., Goldsboro, N. C., bridges construction, Laurens and Union Counties, $9,976. Grand total $2,443,315. Noted Aug. 20.

Tex., Pampa—Gray Co. Comn., c/o R. C. Wilson, aud., grading, drainage 8 mi. McLean-LeFors Rd., to Stuckey Constr. Co., Lubbock, $42,923.

Utah—State Hy. Comn., Salt Lake City, grading, draining, concrete surfacing 8.9 mi. Midland Trail between Detour and Soldier Summit, Utah Co., to J. M. Sumsion, Springville, $59,218.

Washington—S. J. Humes, dir. Hys., Olympia, cleaning, grubbing, grading, draining 8.135 mi. Spokane-Whitworth Rd. and Spokane to Peone Creek Rd., Spokane Co., to Clifton Applegate & Toole, 227 Hutton Bldg., Spokane, $76,208—11.656 mi. Ellensburg-Roza Rd., Kittitas Co., to Interstate Constr. Co., Inc., Bd. Trade Bldg., Portland, Ore., $108,374. Noted Aug. 31.

Wisconsin—State Hy. Comn., Milwaukee and Racine Counties, Milwaukee, concrete paving Milwaukee-Chicago Rd., U. S. Hy. 41, to J. R. Griffith Co., Racine, $299,576.

Wisconsin—State Hy. Comn., Superior, grading 9.934 mi. Amnicon Falls-Maple Rd., U. S. Hy. 2, F.A.P. 375-F, Douglas Co. to J. Runquist, 318 Manhattan Bldg., Duluth, Minn., $90,001.

Ont., Forest Hill—Village, asphalt on concrete paving Eglinton Ave. from Lyons Ave. easterly, to Constructing & Paving Co., Confederation Life Bldg., Toronto, $133,974.

Ont., Hamilton—Widening Barton St. from James to Ottawa Sts., day labor under supervision of W. L. McFaul, city engr., $354,000; widening Cannon St. from Caroline to Lottridge Sts., day labor, $282,000.

Ont., Pembroke—Dpt. Northern Development, Province of Ontario, Parliament Bldgs., Toronto, and Dominion Govt., clearing grading, rock and earth excav., fill, culverts, bridging, relocating existing road 100 mi. hy. between Pembroke and Mattawa, day labor. $1,000,000-$1,500,000. J. Sinton, Parliament Bldgs., Toronto, engr.

EXCAVATION, DRAINAGE, IRRIGATION, LEVEES, RIVER AND HARBOR

PROPOSED WORK

Calif., Los Angeles—Bd. Supervs. Los Angeles Co. voted to transfer $217,000 from Hutchins Dam Fund voted in 1917, to improvement of Pacoima Wash Channel; constructing 7,000 lin.ft. new levee from San Fernando Rd. to Arlita St. A spreading grounds will be constructed between Arlita St. and Payton Ave. to permit and assist the filling of underground reservoirs with storm waters at Pacoima, Wash., for Los Angeles Co. Flood Control Dist. E. C. Eaton, 202 North Bway. engr.

Calif., San Diego—See "Dams."

Tex., El Paso—El Paso Co. and Comrs. Court controlling flood waters of McKellingon Canyon, incl. rein.-con. and earth reservoir, 20,000,000 cu.ft. capacity, at Van Buren and Louisiana Sts. $350,000.

BIDS ASKED

La., Cameron—Sept. 24, by Bd. Levee Comrs. for Gravity D. D. 3, main drainage canals, laterals, incl. 160,000 cu.yd. excav., F. Schutts & Sons, 921½ Ryan St., Lake Charles, engrs.

Tex., Beaumont—Jefferson Co. taking bids on equipment for Intracoastal Canal improvements, incl. materials for flood gates, screw gates and control gates. $40,000. Address County Comrs. Court.

CONTRACTS AWARDED

La., St. Bernard—Police Jury St. Bernard Parish, 2 factory rebuilt 40,000 g.p.m. screw type pumps with 120 hp. Diesel engine, to Fairbanks-Morse & Co., 1000 St. Charles St., New Orleans, $15,075; Lake Borgne Basin Levee Dist., awarded levee and lateral canals, to McWilliams Dredging Co., Canal Bank Bldg., New Orleans, $75,000.

Mass., Cohasset—Dpt. P. Wks., State House, Boston, A. W. Dean, engr., dredging 31,000 cu.yd. to depths 6 and 8 ft. mean low water, in Cohasset Harbor, for Commonwealth of Massachusetts, Boston, to Bay State Dredging & Contg. Co., 62 Condon St., East Boston, $29,890. Noted Sept. 3.

Mass., Marshfield—Dpt. P. Wks., State House, Boston, 4,000 tons heavy rip rap, 3,000 tons stone chips at Brant Rock, to Louis B. Cadario & Sons, 260 Tremont St., Boston, $68,324; 80 jetties, 1,000 tons rip rap, 4,700 ft. seawall, Fieldstone, to R. H. Bergesson, Box 5, Braintree, $14,000. Noted Sept. 3.

N. Y., Alpine—Palisades Interstate Park Comn., L. Deyo, 141 Worth St., New York, 15,000 cu.yd. dredging at Alpine and 15,000 cu.yd. Forest View Basin, to J. P. Randerson, 68 Chapel St., Albany, at $0.4646 per cu.yd. Noted Aug. 19.

Bond Elections

Coming Bond Elections

Earth Dams, Pumping Plants, Power Plant, 35 mi. Canal—San Jose, Calif., Santa Clara Valley Water Conservation Dist. $3,500,000. F. H. Tibbets, San Francisco, Engr.

Waterworks—Lawrenceburg, Ky., Nov., $40,000.

Waterworks—Maysville, Mo., Sept. 15, $50,000.

Bridge and Roads—Madisonville, Ky., Nov. 3., $125,000

Flood Control, Road Widening and Hospital—El Paso, Tex., City and County, $835,000.

Bonds Voted

Waterworks System — Deer Lodge, Mont., $200,000.

Waterworks Ext.—Alice, Tex., $12,000.

Sewage Disposal—Rapid City, S. Dak., $215,000.

Park Impvts.—Mineola, N. Y., $110,000.

Light and Power Plant—Distribution System, Sullivan, Mo., $80,00.

Bonds Defeated

Water Distribution System — Lynneville, Iowa, $18,000.

Light and Power Plant—Le Mars, Ia., $325,000.

FEDERAL GOVERNMENT

PROPOSED WORK

Ala., Auburn—POST OFFICE—Treas. Dpt. at office Sup. Archt., U. S. Post Office, Gay St. and Tichenor Ave. Noted Sept. 3.

California—BRIDGE—Pub. Rds., 461 Market St., San Francisco, El Capitan and Stoneman Bridges, in Valley Floor, Yosemite Natl. Park Hy., Mariposa Co. C. H. Sweetser, 461 Market St., San Francisco, dist. engr.

Calif., Mare Island—BATTERY STORAGE PLANT—Yards & Docks, Navy Dpt., 1 story, steel, rein.-con. plant. $240,000.

N. J., Bloomfield—POST OFFICE—Treas. Dpt. at office Sup. Archt., bids in April, general contract 1 story, basement, brick, steel post office. $250,000. W. O. Bartlett, 11 Raymond Blvd., Newark, archt. Noted July 23.

N. Y., Freeport—POST OFFICE—Treas. Dpt. at office Sup. Archt., U. S. Post office, Merrick Rd. near Ocean Ave. $200,000. Tachau & Vought, 102 East 30th St., New York, archt. **Maturity in February or later.** Noted Sept. 10.

O., Fostoria—POST OFFICE—Treas. Dpt. at office Sup. Archt., plans by Garfield, Stanley-Brown, Harris & Robinson, Natl. City Bldg., Cleveland, brick, stone, steel, concrete, $160,000. J. A. Wetmore, Wash., D. C., acting superv. archt.

Tex., Breckenridge—POST OFFICE—Treas. Dpt. at office Sup. Archt., U. S. Post Office, William St. and Court Ave. $100,000. Architect not appointed.

Tex., Jacksonville—POST OFFICE—Treas. Dpt. at office Sup. Archt., U. S. Post Office, Rusk and Jackson Sts. $135,000.

Tex., Randolph Field—RESERVIOR—Con. Q.M. soon takes new bids covered reservoir. Former bids rejected.

BIDS ASKED

Arizona—ROAD—Sept. 24, by Pub. Rds., c/o Park Sup., Grand Canyon, plant-mixed bituminous treated crushed rock or gravel surfacing 17.109 mi. Sect. D—South Approach to Grand Canyon Natl. Park.

Ariz., Tucson—HANGAR—Sept. 30, at office Con. Q. M. 8th Corps Area, Fort Sam Houston, Tex., 1 air corp utility hangar with 2 annexes.

Calif., March Field—GYMNASIUM-THEATRE—Oct. 13, by Con. Q.M., constructing, completing gymnasium-theatre, March Field; adv. E. N.-R. Sept. 17.

Colorado—TURBINES—Oct. 20, by Bureau Reclamation, Dpt. Interior, two 2300 hp. vertical hydraulic turbines, 2 governors and governor pumps; two 1875 kva. alternating current generators complete with direct connected exciters and thrust bearings; 1 power plant switchboard and auxiliary apparatus for Grand Valley Power Plant, Grand Valley Project; dv. E. N.-R. Sept. 17.

Delaware—DREDGING—Sept. 25, by U. S. Eng., Wilmington, 12,700 cu.yd. from entrance channel to Murderkill River; adv. E. N.-R. Sept. 17.

D. C., Wash.—EXCAVATION, etc.—Sept. 18, by Treas. Dpt. at office Sup. Archt., excavation and found. for U. S. Post Office Dpt. building. Noted June 4.

D. C., Wash.—GASOLINE ENGINE, etc.—Sept. 23, by A. L. Flint, gen. purch. officer, gasoline engine, car wheels, journal boxes, conductor rail, steel, steel billets, pig iron, ingot copper, pig lead, sewer pipe, wrought iron, or steel pipe, etc., Schedule 2684.

Louisiana—EARTHWORK—U. S. Eng., foot Prytania St., New Orleans, 650,000 cu.yd. earthwork on South Bank Red River Levee, 2nd Orleans Dist., to Horton Price Constr. Co., El Dorado, Ark., at $0.0875 per cu.yd. Noted July 19.

La., Shreveport—HEADQUARTERS BUILDING—Con. Q.M. bids about Oct. 5, headquarters building at Barksdale Field.

Miss., Vicksburg—DREDGE TENDER—Oct. 2, by U. S. Eng., 1 Diesel dredge tender to be used in connection with dredge "Todd."

Missouri—REVETMENT—Sept. 26, by U. S. Eng., 428 Customhouse, St. Louis, 4,000 to 9,500 lin.ft. revetment in Missouri River between 30 and 35 miles above mouth; adv. E. N.-R. Sept. 17.

Missouri—PILING DIKES—Sept. 28, by U. S. Eng., 428 Customhouse, St. Louis, 1,500 to 4,000 lin.ft. piling dikes in Missouri River, between miles 30 and 35 above mouth; adv. E. N.-R. Sept. 17.

Mo., Springfield—HOSPITAL—Bureau Prisons, c/o S. Bates, supt., bids about Oct. 1, general contract, 5 story main hospital building, 2 story, basement acute building, 2 story, basement continued treatment building, 2 story, basement infirmary, 2 story, basement storehouse, 1 and 2 story mess hall and auditorium, 1 story, basement laundry, two 2 story basement dormitories, four 2 story staff buildings. $2,500,000. Joannes & Marlow, 420 Lexington Ave., New York, archts. J. A. Wetmore, c/o Treas. July 16.

N. Y., Brooklyn—ALARM SYSTEM—Spec. 6661—Sept. 30, by Yards & Docks, Navy Dpt., sprinkler water flow alarm system, at Naval Supply Depot; adv. E. N.-R. Sept. 17.

N. Y., New York—DREDGING—Oct. 14, by U. S. Eng., Army Bldg., 39 Whitehall St., 304,350 cu.yd. place measurement, in Westchester Creek; adv. E. N.-R. Sept. 17. Noted Sept. 10.

Okla., Fort Sill—ROADWAY—Oct. 6, by Con. Q. M., concrete roadway; and E.N.R. Sept. 17.

Oregon—CANAL, etc.—Bureau Reclamation, Custom House, Denver, Colo., bids about Oct. 18, irrigation project incl. canal, flumes, tunnels, in Mitchell Butte Div., Owyhee Project. $1,500,000. F. A. Banks, Owyhee, engr.

Pa., Altoona—ELEVATORS—Sept. 18, by Treas. Dpt. at office Sup. Archt., elevator plant in U. S. Post Office.

Pa., Carlisle Barracks — STEAM DISTRIBUTING SYSTEM — Sept. 25, by Con. Q. M., underground steam and hot water system.

Pa., Philadelphia—PIER REMOVAL, etc.—Spec. 6654—Sept. 23, by Yards & Docks, Navy Dpt., removing pier and dredging at Navy Yard.

Tenn., Memphis—HOSPITAL—Treas. Dpt. at office Sup. Archt., bids about Jan. 1, 3 story addition to U. S. Marine Hospital, California Ave. $175,000. Regan & Weller, Darmon Bldg., archts. Noted Aug. 27.

Texas—DREDGING—Oct. 7, by U. S. Eng., Galveston, 4,700,000 cu.yd. Houston Ship Channel between Morgan Point and Red Fish Reef; adv. E.N.R. Sept. 17. Noted Sept. 10.

Va., Langley Field—BOILER PLANT, etc.—Sept. 23, by Con. Q. M., installing boiler plant, distribution system.

Va., Langley Field—FUELING SYSTEM—Oct. 5, at office Con. Q.M., gasoline fueling system at Langley Field; adv. E. N.-R. Sept. 17.

Wash., Seattle—LIGHTING FIXTURES—Oct. 1, by Treas. Dpt. at office Sup. Archt., furnishing, installing lighting fixtures in U. S. Marine Hospital; adv. E.N.R. Sept. 17.

Wis., Milwaukee—FILTERS—Sept. 28, by Treas. Dpt. at office Sup. Archt., air filters for heating system at U. S. Post Office, Court House and Custom House; adv. E.N.R. Sept. 17.

Canal Zone—HYDRAULIC APPARATUS, etc.—Oct. 14, by General Purchasing Officer Panama Canal, hydraulic and electrical apparatus for Madden power plant, Schedule 2685.

T. H., Fort Shafter—SEWAGE DISPOSAL PLANT—Con. Q.M. postponed indefinitely taking bids which were to have been opened Aug. 25, sewage pumping plant, repairs, additions. Noted Aug. 12.

CONTRACTS AWARDED

D. C., Wash.—FOUNDATIONS—Treas. Dpt. at office Sup. Archt., founds. for Dpt. Labor and Interstate Commerce Commission, to McCloskey & Co., 1620 West Thompson St., Philadelphia, Pa., $618,730. Noted Aug. 20.

Ga., Dalton—POST OFFICE—Treas. Dpt. at office Sup. Archt., remodeling, enlarging U. S. Post Office, to W. P. Francis & Co., 201 Luckie St., Atlanta, $15,072.

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Federal Government (Continued)

Ill., Mendota—POST OFFICE—Treas. Dpt. at office Sup. Archt., 1 story, basement, 58 x 72 ft. and 22 x 24 ft. post office, Washington St., to J. McHugh, 840 West 70th St., Chicago. $45,980. Est. $50,000. Noted July 30.

Ill., Rock Island—SEWERS, etc.—U. S. Eng. sewerage system, at Rock Island Arsenal, to Woods Bros., 132 South 13th St., Lincoln, Neb., $71,708. Noted Aug. 6.

Ia., Cedar Rapids—POST OFFICE—Treas. Dpt. at office Sup. Archt., Post Office, to J. P. Cullen & Sons, Janesville, Wis., $372,386. Noted Aug. 6.

Ky., Louisville—DREDGING—U. S. Eng., P. O. Box 72, 40,000 cu.yd. rock from lower end auxiliary locks, to Ohio Dredging Co., Pittsburgh, Pa. Noted July 30.

Ky., Murray—POST OFFICE—Treas. Dpt. at office Sup. Archt., U. S. Post Office, to Samford Bros., Montgomery, Ala., $71,900. Noted June 25.

Louisiana — DREDGING — U. S. Eng., New Orleans, to Howard Kenyon Dredging Co., 3603 McKinley St., Houston, Tex., 155,000 cu.yd. St. Joseph Levee $15,856, 260,000 cu.yd. Woodside Levee $26,598, 135,000 cu.yd. Bayou Current Levee $13,811, all above in Red River Atchafalaya and Bayou Boeuf Levee Dist.; to New Constr. Co., Shreveport, 170,000 cu.yd. Riverside Enlargement, $16,830; to Powell Bros. Georgetown, Miss., 50,000 cu.yd. Davis Front Enlargement, Riverside Enlargement, $10,075, both in Atchafalaya Back Levee Dist., 2nd New Orleans Levee Dist. Grand total $484,170.

La., New Orleans—LEVEES—U. S. Eng., to Powell Bros., Georgetown, Miss., constructing Bonnet Carre Side Levees, 2nd New Orleans Levee Dist., 10,000 cu.yd. at $0.23 per cu.yd.; 9,000 cu.yd. $0.25; 20,000 cu.yd. $0.28. Noted Aug. 6.

La., New Orleans—PILING, etc.—U. S. Lighthouse Serv., 163,126 ft. creosoted piling and lumber, to Republic Creosoting Co., Water St., Mobile, Ala., $12,478.

Me., Portland—DREDGING—U. S. Eng., Custom House, Boston, Mass., 184,500 cu.yd. from Portland Harbor, to Trimount Dredging Co., 10 State St., Boston, Mass. Est. $25,000. Noted Aug. 20.

Mo., Missouri City—CLUMP DIKES—U. S. Eng., Telegraph Bldg., Kansas City, 3,300 lin.ft. pile clump dikes in Missouri River at Jackson and Missouri City Bends, to C. W. Hunter Co., 177 South Front St., Memphis, Tenn., $54,305. Noted Aug. 12.

N. H., Somersworth—POST OFFICE—Treas. Dpt. at office Sup. Archt., constructing U. S. Post Office, to W. H. Trumbull, Hanover, $64,290. Noted Aug. 6.

N. Y., Jamaica—POST OFFICE—Treas. Dpt. at office Sup. Archt., plans by Cross & Cross, 385 Madison Ave., New York, U. S. Post Office, $875,000.

N. Y., Sumount — NURSES BUILDINGS — Vet. Bu., Arlington Bldg., nurses quarters, to Adams Constr. Co., Wash., D. C., $167,900. Noted July 6.

O., Millersburg—POST OFFICE—Treas. Dpt. at office Sup. Archt., 50 x 75 ft. concrete, brick, stone post office, 20 ft. high with 12 x 20 ft. loading platform, to D. B. Hussey, Inc., 1174 West 5th Ave., Columbus, $53,000. Noted July 30.

Okla., Hobart—POST OFFICE—Treas. Dpt. at office Sup. Archt., U. S. Post Office, to Upchurch Constr. Co., Montgomery, Ala., $67,400.

Oregon—JETTY—U. S. Eng., Portland, repair work on jetty, at mouth of Columbia River, to Columbia Contg. Co., Portland, $1,204,606. Noted Aug. 6.

Pa., Carlisle Barracks—SEWAGE DISPOSAL SYSTEM—Con. Q. M., sewage disposal system for stable, to New York Sewage Disposal Co., Grand Central Terminal, New York, $1,890. Noted July 30.

Pa., Kittanning—DREDGING—U. S. Eng., Keenan Bldg., Pittsburgh, 1,240,000 cu.yd. lower approach channel, Lock 7, Allegheny River, to General Contg. Corp., Columbia Bank Bldg., Pittsburgh, at $0.26 per cu.yd. Noted Aug. 19.

Tex., Randolph Field—LIGHTING SYSTEM—Con. Q.M., night lighting system, to Kirkwood, Wharton & Lee, 518 North Flores St., San Antonio, $18,000. Noted July 7 Daily.

Tex., Randolph Field—RESERVOIRS—Con. Q.M., 4 open reservoirs, to J. L. Black, 122 Tremlett St., San Antonio, $24,710.

Va., Yorktown—DISTRIBUTION SYSTEM—Natl. Monument, Dpt. Interior, Natl. Park Serv., installing water distribution system, mains, valves, to Virginia Eng. Co., Inc., Newport News, $15,848. Noted July 16.

Wash., Seattle—STEEL—Treas. Dpt. at office Sup. Archt., furnishing and erecting 2,700 tons structural steel for federal building, to Isaacson Iron Wks., 2917 East Marginal St. $200,000.

Wyoming—ROAD—Pub. Rds., Denver, Colo., grading 5.225 mi. Centennial-Saratoga Forest Rd. Project Sect. F, to Morrison-Knudsen Co., Boise, Idaho, $80,111.

Canal Zone—DAM—H. Burgess, gov. Panama Canal, Munitions Bldg., Wash., D. C., constructing Madden Dam, to W. E. Callahan Constr. Co., 1220 Arcade Bldg., St. Louis, Mo., and Peterson, Shirley & Gunther, 1411 WOW Bldg., Omaha, Neb., $4,048,657. Noted June 25.

FEDERAL POWER COMMISSION

Applications for License and Permits

Licenses

1169—W. H. Welch, Twin Bridges, Calif., wants license small project on Pyramid Creek within Eldorado Natl. Forest, in El Dorado Co.

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1170——Mount Princeton Granite Co., Denver, Colo., wants license power development on Chalk Creek tributary to Arkansas River, within Cochetopa Natl. Forest, Chaffee Co.

1171—Southern Sierras Power Co., Riverside, Calif., wants license transmission line on public lands in Mono Co.

GRADE CROSSINGS

PROPOSED WORK

Ont., Port Colborne—Town and Canadian National Rys., C. S. Gzowski, ch. engr. constr., Montreal, Que., concrete, structural steel subway under railroad tracks, King St. Crossing. $50,000. C. A. Grassie, town engr.

CONTRACTS AWARDED

Md., Baltimore—Pennsylvania R.R., T. J. Skillman, ch. engr., Broad St. Sta., Phila., Pa., undergrade bridges over Gay St., Preston and Wolfe Sts., Washington and Biddle Sts., relocating Ellsworth St., constructing new Biddle St. Station and platforms, to Arundel Corp., Pier 2, Pratt St. Noted Aug. 27.

N. Y., Mineola—Long Island R.R. Co., A. C. Watson, ch. engr., Pennsylvania Sta., New York, reconstructing existing bridge carrying Franklin Ave. over railroad tracks, to F. H. Clement & Co., Bethlehem, Pa., $25,017. Est. $44,572. Noted July 25, 1920.

O., Steubenville—See "Streets and Roads."

DAMS

PROPOSED WORK

Calif., San Diego—City Council authorized H. N. Savage, engr., City Hall, to prepare plans earth and rock fill dam and extension of El Capitan Lakeside to site of dam, dam not less than 197 ft. in height, sufficient capacity to provide not less than 11,600,000 gal. water daily delivered to University Heights Reservoir. The supply of about 6 m.g. daily from El Capitan Pipe Line will be used during construction of dam. $5,000,000.

CONTRACTS AWARDED

Pa., Jamestown—See "Waterworks."

PIERS AND WHARVES

PROPOSED WORK

Calif., San Francisco—WHARF—See "Unclassified."

Calif., San Francisco—PIERS, etc.—California State Harbor Comn. Ferry Bldg., extending Pier 46, about 200 ft., creosoted and redwood timber construction, $175,000; additions and improvements to Piers 42 and 44, incl. creosoted pile, creosoted and redwood timber substructures, timber sheds, $450,000; Pier 20, 100 x 780 ft., steel frame shed, concrete walls, steel rolling doors. $200,000. F. G. White, Ferry Bldg., engr.

Mass., Bourne — PIER — Commonwealth of Massachusetts, Dpt. P. Wks., State House, Boston, state pier. $25,000 or more. A. W. Dean, Dpt. P. Wks., Boston, engr.

Mass., Chilmark—WHARF—Town, Bd. Selectmen, reconstructing, repairing town wharf. Est. $25,000.

CONTRACTS AWARDED

R. I., Providence—WHARF, PIER SHED, etc. State of Rhode Island Comn., State House, 120 x 620 ft. wharf and 55 x 256 ft. shed, Allens Ave., to Central Eng. & Constr. Co., 210 Main St., Pawtucket, $254,000 and $90,000 respectively. Noted Aug. 27.

AIRPORTS

PROPOSED WORK

Minn., Duluth—C. D. Jeronimus, city clk., soon takes bids hangar. $45,000. Sullivan & Orrfalt, 410 Palladio Bldg., archts.

GRAIN ELEVATORS

CONTRACTS AWARDED

Tex., Sherman—ELEVATOR—Diamond Mill & Elevator, Fort Worth, 400,000 bu. addition to elevator, to Jones-Hettelsater Constr. Co., 600 Mutual Bldg., Kansas City, Mo.

Wis., Manitowoc — GRAIN ELEVATOR—Cereal Products Co., 305 Washington St., 1 story 500,000 bu. grain elevator, to McKenzie-Harper Co., Corn Exchange Bldg., Minneapolis, Minn.

POWER AND LIGHTING

BIDS ASKED

Missouri—See "Contracts Awarded."

N. Y., New York—Sept. 22, by W. C. Martin, archt. and supt. School Buildings, Flatbush Ave. extension, Concord St., Brooklyn, electrical work for Samuel Gompers Industrial High School for Boys, Tinton and Wales Aves., East 145th and 147th Sts., for Bd. Educ., 500 Park Ave.

Wash., Seattle—Sept. 29, by S. J. Humes, dir. Hys., Olympia, electric lighting system for Lake Union Bridge and approaches on State Rd. 1, King Co. Noted Sept. 3, under "Bridges."

CONTRACTS AWARDED

Missouri—Missouri Power & Light Co., Brookfield, will construct 12 mi. 6,600 volt line from Brookfield to Linneus, own forces. Private plans.

PARKS AND SPORTS

PROPOSED WORK

Mass., Brookline—Rivers School, 296 Dean Rd., red brick squash court. $25,000. Kilham, Hopkins & Greeley, 9 Park St., Boston, engrs.

Mass., Lynn—City, A. Comstock, Park Dpt., brick bath house at Flax Pond.

N. Y., Mineola — Plans park and recreation center on Emory St. near Mineola High School. $110,000.

N. Y., New York—Bd. Educ., 500 Park Ave., plans by W. C. Martin, Flatbush Ave. extension and Concord St., Brooklyn, bleachers, field house, storage, Gunhill Rd. and Wallace Pl. $115,000.

BBIDS ASKED

Mass., Boston—Sept. 25, by Park Dpt., 33 Beacon St., grading in and about Jefferson Playground, Roxbury. $25,000.

N. Y., Brooklyn—Sept. 22, by Park Bd., W. R. Herrick, pres. Park Dpt., Arsenal Bldg., Central Park, New York, improving north addition Brooklyn Botanic Garden incl., grading, asphaltic and flagwalks, ten pergolas, etc.

N. Y., New York—Sept. 22, by Park Dpt., Arsenal Bldg., Central Park, field house in Highbridge Park, new heating coils in palm house, tropical house and fern house, of greenhouses, Central Park.

N. Y., Rockaway—Sept. 22, by Park Bd., W. R. Herrick, pres. Park Dpt., Arsenal Bldg., Central Park, New York, bathing pavilion incl. heating, plumbing, electrical work in Jacob Riis Park, Stoughton & Plock, 250 East 43rd St., New York, archts and engrs.

CONTRACTS AWARDED

Me., Windham—Town, Bd. Selectmen, 1 story, auditorium and gymnasium, high school grounds to W. C. and J. S. French, Stevens Ave., Portland. Est. $25,000. Noted May 14.

Nev., Reno—Reno Sports Palace, P. E. Grosbeck, vice-pres., 420 Roberts St., 175 x 228 ft. ice skating rink, bowling alley, concession quarters, stores, East 4th St., to Ellis & Matteson, 228 North Virginia St.

N. Y., Brooklyn—Park Bd., W. R. Herrick, pres. Park Dpt. Arsenal Bldg., Central Park, New York, erecting, completing field house, comfort station in Playground 8, to F. A. Regan Constr. Co., 1008 4th St., $13,790. Noted Aug. 13.

HEATING AND VENTILATING

PROPOSED WORK

Ind., Independence—L. Colvin, general contractor, 803 Continental Bank Bldg., soon lets contract heating, ventilating, plumbing, steam boilers, fans, motors, vacuum pumps, air filters, sewage pumps, water cooler, hot water pumps, for Indiana Bell Telephone Co., 256 North Meridian St. $100,000. Noted Feb. 19, under "Buildings—Unclassified."

CONTRACTS AWARDED

Mass., Boston—Home for Aged Women, South Huntington Ave., heating in home for aged women, South Huntington Ave., to McMurrer Co., 303 Congress St.; plumbing, to J. A. Cotter Co., 334 Shawmut Ave.; electrical work, to H. M. Haley Electric Co., 165 Pearl St. Est. $25,000. Noted Aug. 20, under "Buildings—Unclassified."

UNCLASSIFIED

PROPOSED WORK

Calif., San Francisco—COTTON TERMINAL—California State Harbor Comn., Ferry Bldg., cotton terminal, incl. timber wharf extension, steel frame, concrete shed at Outer Islais Creek. $555,000. F. G. White, Ferry Bldg., engr.

Calif., San Francisco—GRAIN SHED—California State Harbor Comn., Ferry Bldg., 100 ft. extension to grain shed, constructing additional bins at Islais Creek Terminal. $60,000. F. G. White, Ferry Bldg., engr.

Conn., New Britain—WIRE DUCTS—City, E. N. Humphrey, P. Wks., authorized $70,000 expenditure for 2,450 ft. subway wire ducts, Black Rock Ave. P. A. Merian, City Hall, engr.

Ia., Des Moines—BUS STATION—Interstate Transit Lines, 422 Grand St., plans by R. E. Sawyer, 601 Flynn Bldg., remodeling Union Bus Depot, brick, concrete, 5th and Grand Ave. $50,000. Will not build 1 and 2 story station at 4th St. and Court Ave., Project abandoned on account of change in bus routes. Noted May 28.

Nev., Boulder City—SAND and GRAVEL PLANT—Six Companies, 405 Montgomery St., San Francisco, Calif., sand and gravel plant, steel, concrete. $250,000, incl. equipment. Ellison & Russell, Pacific Bldg., San Francisco, Calif., structural engrs.

Nev., Las Vegas—COTTAGES—Six Companies, Inc., Boulder City, one hundred 2 room and one hundred 3 room cottages, other miscellaneous buildings. F. C. Crowe, Boulder City, engr.

N. Y., New York—COAL POCKETS, etc.—Cullen Fuel Co., 192 Lexington Ave., plans by Nicholson Co., 405 Lexington Ave., 49 x 76 ft. coal pockets, 100 x 730 ft. scale house and office, Ferris Pl. and Kirk St. To exceed $40,000.

N. Y., New York—COAL POCKETS—McNulty Bros. Coal Co., 1932 Arthur Ave., plans by S. Kessler, 125 West 45th St., 1 story frame coal pockets, 171st St. and Harlem River.

Pa., Erie—BULK OIL STORAGE and DISTRIBUTION STATION—Emblem Oil Co., Warren, bulk oil storage and distribution station. $50,000.

Unclassified (Continued)

Tex., Kilgore—TANK FARM—Prairie Pipe Line Co., Independence, Kan., tank farm on 524 acre tract, south of Sabine River, near here, incl. steel tanks, 25,000 to 220,000 gal. gathering lines, etc. Private plans.

Tex., Santa Anna—STONE and ROCK QUARRY MACHINERY—Santa Anna Rock & Stone Wks., c/o R. D. Golston, Santa Anna, installing gang saw, rubbing bed, carborundum planer, cutoff saw, lathe and polishing machine. Equipment not purchased. $35,000 equipment. Private plans.

Va., Norfolk—FRUIT TERMINAL—Norfolk & Western Ry. Co., Roanoke, W. P. Wiltsee, ch. engr., purchased site and plans fruit terminal, Water St.

BIDS ASKED

Pa., Phila.—TEST BORINGS—Sept. 22, by Dpt. City Transit, C. E. Myers, dir., City Hall Annex, Contr. 9, test borings in Roosevelt Blvd.-Broad Street Stenton Ave.; Contr. 248, alterations, additions to City Hall Station, miscellaneous work.

Maryland—ELECTRICAL WORK—Sept. 22, by Dpt. P. Wks., State Roads Com., Baltimore, G. C. Uhl, chn., all electrical work necessary for complete electric lighting system for railroad grade elimination at Bare Hills, on Falls Rd. Contr. B-226-43, Baltimore Co.; adv. E. N.-R. Sept. 17.

CONTRACTS AWARDED

Ala., Birmingham — TRAIN SHEDS — Louisville & Nashville R.R., W. H. Courtenay, ch. engr., Louisville, Ky., concrete, steel butterfly type trainsheds adjoining passenger station, to Southern Constr. Co., Inc., 615 South 11th St., Birmingham, $37,400.

Mass., Boston—COAL POCKETS — Burns Bros., 185 Summer St., concrete, timber coal pockets, 1022 Mass. Ave., to Nicholson Co., Chrysler Bldg., New York. Est. $25,000.

Mass., Boston—ROOF GARDEN—Motor Mart Garage, Park Sq., roof garden, top addition to garage, Columbus Ave., Broadway and Stuart Sts., to Marden Constr. Co., 46 Cornhill. Est. $25,000.

N. Y., New York—ELEVATORS, etc.—Franciscan Fathers, 133 West 31st St., elevators, plumbing, equipment for alterations to monastery, 133 West 31st St., to Frederick G. Necker & Co., 651 West 188th St. Est. $50,000.

N. Y., Staten Island—PLUMBING—J. G. W. Greeff, comr. Dpt. Hospitals, Municipal Bldg., New York, plumbing for male pavilions at New York City Farm Colony, to S. L. Snyder Co., 333 West 52nd St., New York, $64,990. Noted Sept. 10.

N. Y., Wayne — PIPE LINE — Cunningham Gas Co., Eastern States Natl. Gas Co., and Belmont-Quadrangle Co., Wayne, gas gathering pipe lines, to Rich & Co., Bradford, Pa. Est. exceeds $25,000.

W. Va., Newell — TUNNEL KILN — See "Factories and Mills."

MATERIALS

BIDS ASKED

CAST IRON PIPE, etc.—**Anaheim, Calif.**—Sept. 22, by E. B. Merritt, city clk., 4,800 ft. 4 in., 3,000 ft. 6 in., 1,600 ft. 8 in. Class B c.i. pipe or 3,000 lb. fittings, all A.W.W.A. Standard.

ROCK, GRAVEL, OIL etc.—**Ventura, Calif.**—Bd. Supervs. Ventura Co., will purchase in open market 10,000 tons crushed rock, 10,000 tons gravel, 10,000 tons sand, 10,000 bbl. road oil, 5,000 tons asphaltum, 10,000 bbl. emulsified asphaltum for roads. Former bids rejected. Noted Aug. 14.

CEMENT—**Baltimore, Md.**—Sept. 23, by Bd. Awards, T. Mottu, City Hall, purch. agt., furnishing cement to various bureaus and city departments.

CONTRACTS AWARDED

SLAG, etc.—**Orlando, Fla.**—Orange Co., 1,450 tons slag, to Birmingham Slag Co., Comer Bldg., Birmingham, Ala., at $4.15 per ton; 25,000 tons lime rock, to Peninsula Lime Rock Co., J. R. Merle, Orlando, representative, $1.64; 12,450 gal. tar prime, to Barrett Tar Co., 36th St. and Grays Ferry Ave., Phila., Pa., at $0.137 per gal.; 24,850 gal. tar prime, to Mexican Petroleum Co., Tallahassee, at $0.0525. Total est., $73,000.

ROAD OIL—**Iowa**—See "Streets and Roads."

EQUIPMENT

PROPOSED WORK

STREET PLANER—**Oakland Calif.**—City purchasing in open market, 4-wheel motor street planer for Street Dpt. F. C. Merritt, city clk.

SNOW PLOW, etc.—**Sturgeon Bay, Wis.**—Door Co., c/o R. Bieri, purchasing snow plow and snow removal equipment. Private plans.

BIDS ASKED

PUMP, MOTOR, etc.—**Davis, Calif.**—City Clerk taking bids deep well pump complete, and 50 hp., 440 volt, 3 phase, 60 cycle electric motor for Well 3.

ROLLING DOORS—**San Francisco, Calif.**—Oct. 1, by State Bd. Harbor Comn., Ferry Bldg., 7 steel rolling doors for Pier 39.

CONCRETE SAW—**Wash., D. C.**—Sept. 23, by District Comrs., District Bldg., concrete saw.

TRUCKS—**Wash., D. C.**—Sept. 21, by District Comrs., District Bldg., seven 1½ ton trucks.

AIR COMPRESSOR — **Altamont, Ill.** — G. Winter in market air compressor, 2-cylinder, about 80 cu.ft., 80 lb. pressure.

PUMP and EQUIPMENT—**Boston, Mass.**—Sept. 23, by Hospital Dpt., oil pump and heating equipment in power plant, City Hospital, Harrison Ave.

VENTILATING FAN, etc.—**Boston, Mass.**—Oct. 14, by Transit Dpt., 1 Beacon St., ventilating fans, motors in Boston and East Boston Ventilation Buildings of Traffic Tunnel, E. R. Springer, ch. engr.; adv. E. N.-R. Sept. 17.

TURBINE GENERATING UNIT—**Norfolk, Mass.** — Sept. 18, by Dpt. Correction, State House, turbine generating unit and switchboard complete at State Prison Colony. R. D. Kimball Co., 6 Beacon St., Boston, engrs.

GRADER—**Brainerd, Minn.**—Oct. 6, by F. M. Hagberg, aud. Crow Wing Co., 1 pull-type grader with 14 in. blade.

BLADE GRADER—**Mora, Minn.**—Sept. 22, by G. G. Billstrom, aud. Kanabec Co., 12 ft. blade grader, 8,000 lb., pull type, to be used with caterpillar tractor.

CONCRETE MIXER—**St. Louis, Mo.**—R. E. Luck, 5627 Nottingham Ave., in market, concrete mixer.

SNOW LOADERS, etc.—**New York, N. Y.**—Sept. 18, by P. J. Dooling, comr. Purchase, Municipal Bldg., motor driven snow loaders, to Dpt. Sanitation; turbine blowers to Dpt. Plant & Structures.

TRACTOR, etc.—**Cleveland, O.**—Sept. 25, by City, D. E. Morgan, city mgr., 1 each caterpillar tractor, and backfiller.

GENERATOR, etc.—**Ford City, Pa.**—Sept. 22, by City, A. B. Mahoney, city clk., power plant improvements, Contr. 1, furnishing, installing one 500 kw. or two 250 kw. Diesel oil engine generator; Contr. 2, furnishing, installing cooling tower, closed type cooling system for 1,500 brake hp. of Diesel oil and overload storage tank and auxiliaries. Burns & McDonnell Eng. Co., Interstate Bldg., Kansas City, Mo., engrs.

POWER GRADER—**Appleton, Wis.**—Oct. 7, by City, C. J. Becher, clk., 1 large power grader.

SWITCHGEARS, etc.—**Ottawa, Ont.**—Sept. 25, by Ottawa Hydro-Electric Comn., J. E. Brown, genl. mgr., 75 Laurier Ave., W., one 11,000 volt and one 2,200 volt switchgears, three 5,000 kva. three phase, oil insulated self-cooled transformers.

CONTRACTS AWARDED

HYDRANTS, etc.—**Boston, Mass.**—City, Dpt. P. Wks., J. A. Rourke, comr., hydrants, gates to McCulloch Mfg. Co., 200 Old Colony Ave., South Boston, $7,802.

BOILER, STOKER, CINDER TRAP, etc.—**Howard, R. I.** — State Public Welfare Comn., State House, Providence, F. J. Fernell, chn., furnishing, installing boiler, to Wicks Boiler Co., Saginaw, Mich., $8,171; stoker, to Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., $4,850; cinder trap, to Green Fuel Economizer Co., 201 Devonshire St., Boston, Mass., $3,946; service main insulation, to R. I. Covering Co., 351 South Main St., Providence, $4,478; service main, to Underground Steam Constr. Co., 75 Pitts St., Boston, Mass., $15,700; refrigeration, to Refrigeration Co., Inc., 325 Canal St., Providence, $2,670; elevator, to Otis Elevator Co., 130 Clarendon St., Boston, Mass., $1,545. Grand total $41,360. Noted Aug. 20.

FOREIGN

Australia, West Perth — Western Australia Match Co., Ltd., c/o Federal Match Co., Melbourne, plans match factory. To exceed $40,000.

Egypt, Cairo—Dec. 22, by Ministry of Interior, supplying, erecting complete electric power station at Tantah.

New Zealand, Wellington—Oct. 21, by Secretary Posts & Telegraphs, Dpt. 3 mi. tinned annealed copper wire 1,044 in. vulcanized india rubber insulated, taped and braided.

New Zealand, Wellington—Nov. 17, by Secretary P. Wks. Dpt., four 3,333 kva. oil immersed self controlled transformers.

New Zealand, Wellington—Nov. 19, by Secretary Post & Telegraph Dpt., apparatus for intercall selective telephone system: 2 wire repeater and 50 line magneto switchboard, to be installed between Christchurch and Invercargill, with Duneden as divisional point, where repeater and switchboard will be situated.

U.S.S.R., Moscow—Soviet Government, c/o Amtorg Trading Corp., 261 5th Ave., New York, receiving competitive sketches until Oct. 20, from Soviet and foreign architects for Palace of Soviets (government or capitol building). To exceed $10,000,000.

Commercial Buildings

RESIDENTIAL

BIDS ASKED

Calif., Hollywood—Hollywood & Stanley Ltd., taking bids from selected list of contractors Class A apartment, Stanley and Hollywood Blvds. $150,000. L. A. Bryant, 6513 Hollywood Blvd., archt.

Calif., Los Angeles—Reich-Nevada Corp., 1214 Wilshire Blvd., taking sub-contract figures 7 story, basement, 70 x 140 ft., rein.-con., steel sash, wrought iron, apartment, incinerator, 300 block on Rossmore Ave. $160,000. Scherer & Shaw, 1510 North Vermont Ave., archts.

Calif., Los Angeles—See "Contracts Awarded."

N. J., West Orange—See "Contracts Awarded."

N. Y., Astoria—See "Contracts Awarded."

N. Y., Brooklyn—See "Contracts Awarded."

N. Y., Jamaica—Spitzer Properties, Inc., 16 Court St., Brooklyn, bids in October, separate contracts apartment, 149th St. To exceed $200,000.

N. Y., New York—M. H. Brandt, 12 East 43d St., bids late in fall, general and separate contracts apartment, Riverside Dr. and 155th St. To exceed $300,000.

N. Y., New York—See "Contracts Awarded."

N. Y., New York—Seventy-Six West End Corp., 331 Madison Ave., plans by Boak & Paris, 10 East 40th St., bids in fall on separate contracts, 19 story, 334 West End Ave.

N. Y., Westbury—See "Contracts Awarded."

CONTRACTS AWARDED

Calif., Los Angeles—Reich-Nevada Corp., 1214 Wilshire Blvd., 7 story, basement, rein.-con., Rossmore Ave., day labor. $175,000.

N. J., West Orange—Robert Paterson, Inc., 116 Market St., Newark, 5 story, basement, 100 x 115 ft., brick, steel, Washington St., separate contracts. $200,000. Harris & Sohn, 17 Mechanic St., Newark, archts.

N. Y., Astoria—Academy Developers, Chatham Phoenix Bldg., Long Island City, 6 story apartment, Bway and 32nd St., separate contracts. $150,000. B. Braunstein, 163-18 Jamaica Ave., Jamaica, archt.

N. Y., Brooklyn—Ben Jac Realty Corp., B. Straus, pres., 2 story, East 51st and Winthrop St., separate contracts. $150,000. J. J. Millman, 67 Court St., archt.

N. Y., Brooklyn—Chadwick Realty Corp., S. Soffin, pres., 26 Court St., 4 story, 87 x 100 ft., Dahill Rd. and Avenue O, separate contracts. $150,000. Charin & Ungerleider, 186 Remsen St., archt.

N. Y., Brooklyn—I. and I. Realty Corp., I. Funt, pres., 2330 65th St., 6 story, 100 x 120 ft., West 1st St. and Avenue P, separate contracts. $450,000. B. Jalkow, 375 Fulton St., archt.

N. Y., Brooklyn—H. Kraushar, c/o Malkind & Weinstein, archts., 93 Court St., 6 story, 92 x 183 ft., Washington Ave. and Sullivan Pl., separate contracts. $350,000.

N. Y., New York—F. Castolada, 3553 Willett Ave., apartment, Bronxwood Ave. and 211th St., separate contracts. $150,000. M. F. DePace, 4740 White Plains Ave., archt.

N. Y., New York—Corporation, c/o D. Markbreiter, 1854 Harrison Ave., 6 story, Stratford Ave. and 174th St., separate contracts. $150,000. G. W. Swiller, 4215 3rd Ave., archt.

N. Y., New York—Corporation, c/o M. Galt, 277 Bway., 6 story, 80 x 114 ft., Barnes Ave. and 225th St., separate contracts. $175,000. R. E. Golden, 2419 Webster Ave., archt.

N. Y., New York—Huxley Building Corp., G. McWickes, secy., 15 West 44th St., 2 story, basement, brick, steel, 254th St. and Sylvan Ave., separate contracts. $150,000. C. G. De Neergaard, 246th St. and Boston Post Rd., archt.

N. Y., New York—I. B. and S. L. Building Corp., 1342 Fteley Ave., 2 story, Fteley Ave. and 174th St., separate contracts. $150,000. Kavy & Kavovitt, 350 Stone Ave., Brooklyn, archts.

N. Y., New York—Samray Building Co., S. Derfner, pres., 171 Gunhill Rd., 6 story, 84 x 125 ft., Gunhill Rd. and Bainbridge Ave., separate contracts. $250,000. J. L. Crausman, 332 East 149th St., archt.

N. Y., New York—Tenbrook Development Corp., C. F. Haring, pres., 1440 Bway., 2 story, Tenbrook and Rhinelander Aves., separate contracts. $150,000. G. E. Quinby, 27 Frazer St., Pelham, archt.

N. Y., New York—Two Hundred and Third Street Holding Corp., J. Geltman, in charge, 1910 Arthur Ave., 6 story, 63 x 114 ft., 1 Nelson Ave. and Macombs Rd., separate contracts. $150,000. G. W. Swiller, 4215 3d Ave., archt.

N. Y., Westbury—C. M. Hiesinger, Westbury and Ellison Aves., 2 story, Westbury Gardens, separate contracts. To exceed $500,000.

Ont., Toronto—Syndicate, c/o H. C. Roberts, archt., Bloor-Bay Bldg., three 5 story, basement, 45 x 128 ft., brick, stone, concrete apartment units, Avenue Rd. to United Constr. Co., Bloor-Bay Bldg. Est. $260,000.

CLUBS

PROPOSED WORK

N. J., Hohokus—Owner, c/o P. J. Jossier, archt., 240 Broad Ave., Palisades Park, 2 story, basement, brick, steel golf club. $150,000. **Maturity probably in November.** Noted Aug. 27.

N. J., Paterson—Owner, c/o Goodman & Schulman, archts., 20 Smith St., 2 story, basement, brick, steel clubhouse, 12th Ave. and Carroll St. $150,000.

N. Y., New York—Mid-York Club, 100 East 42nd St., will not build club. To exceed $1,000,000. Project abandoned. Noted Nov. 28, 1929.

CONTRACTS AWARDED

Md., Baltimore—J. E. Sperry, archt., Calvert Bldg., 2 story, basement, 77 x 155 ft., brick, hollow tile, concrete, marble clubhouse, to Consolidated Eng. Co., 20 East Franklin St., for Baltimore Country Club, Heywood Boyce, 4 Club Rd. $225,000. Noted Sept. 3.

N. Y., New York—Union Club of New York, 5th Ave. and 51st St., 5 story club, 69th St. and Park Ave., to C. T. Wills, 286 5th Ave. Est. $850,000.

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Clubs (Continued)

Pa., Erie—Y. M. C. A., O. C. Hitchcock, pres., 31 West 10th St., 7 story, 50 x 100 ft., brick, steel club, 31 West 10th St., to Upton & Lang, 1009 Commerce Bldg., $202,352. Noted July 23.

HOSPITALS

PROPOSED WORK

Mass., Springfield—City, D. R. Winter, mayor, receiving competitive sketches infirmary, $150,000.

Mass., Ware—Mary Lane Hospital, A. Wetherbee, pres., South St., hospital addition, $150,000. Architect not appointed.

Mich., Detroit—St. Mary's Hospital plans by F. J. Winter, 2111 Book Tower, 4 story, basement, brick, steel, rein.-con., plain found., St. Antoine St. $200,000.

Tenn., Bolivar—State, R. Lyle, supt. Institutions, Nashville, bids in October, addition to West Tennessee Hospital, $500,000. H. C. Hibbs, Amer. Trust Bldg., Nashville, archt.

Tenn., Memphis—J. C. Dean, 433 South Highland Ave., chn. Bd. Trustees General Hospital, and Mayor W. Overton, trustee John Gaston Memorial Fund, sketches rein.-con., brick, stone hospital. $600,000. Noted Sept. 11.

BIDS ASKED

Calif., Los Angeles—A. C. Martin, archt., Higgins Bldg., taking bids 10 story, basement, concrete steel hospital, Bellevue Ave., for Queen of Angeles Hospital, 2301 Bellevue Ave. $350,000. Noted Aug. 13.

Conn., Shelton—Sept. 28, by State Tuberculosis Comn., Senate Chamber, State Capital, Hartford, brick, steel infirmary and 2 physicians cottages, $500,000. Cudworth & Thompson, 257 Main St., Norwich, archts. Bidders file with architect by Sept. 17. Noted Apr. 2.

Pa., Phila.—Sept. 22, by Wills Hospital, c/o E. S. Stewart, Lafayette Bldg., 7 story, basement, 171 x 198 ft., rein.-con., brick, steel plain found., 16th and Spring Garden Sts. J. T. Windrim, 1201 Chestnut St., archt.

CONTRACTS AWARDED

Mass., Dorchester—Commonwealth of Massachusetts, Dpt. Mental Diseases, State House, Boston, 3 story, basement, brick, stone, steel reception building, plain found. at Boston State Hospital, to Griffin-Bordiere Constr. Co., 60 State St., Boston, $237,500; heating and ventilating, to R. H. Baker Co., 238 Main St., Cambridge, $34,400; plumbing, to J. S. Cassidy, 133 Austin St., Cambridge, $27,880; electrical work, to Sword Bros., 17 Mystic Ave., Arlington, $7,450. Grand total $307,230. Noted Aug. 20.

Mich., Port Huron—Port Huron Hospital Assn., general contract, 4 and 6 story, brick, steel, rein.-con. steel, plain found., to Sorensen & Gross Co., Flint. $175,500. Noted June 25.

N. Y., New York—Presbyterian Hospital, 620 West 168th St., general contract eye institute, to Marc Eidlitz, 100 East 42nd St., excav. to Clemente Contg. Co., East Mount Eden Ave.; structural steel, to Lehigh Structural Steel Co., 17 Battery Pl. Est. $1,100,000. Contractor takes other separate contract bids later. Noted Sept. 10.

N. Y., Wingdale—Dpt. Mental Hygiene, State Office Bldg., Albany, constructing Buildings 18, 19, 20, 21, 22, 23, 29, 30, 31, 32, 33, and 34 and service tunnel at Harlem Valley State Hospital, to R. J. Murphy, 55 West 42nd St., New York, $1,943,519; heating, to Chippewa Plumbing Co., 279 Chicago St., Buffalo, $588,223; sanitary work, to Hoffman Wolfe Co., 11 West Ritterhouse St., Phila., Pa., $131,000; electrical work, to Fischback & Moore, 226 East 41st St., New York, $186,000. Grand total $2,848,742. Noted July 30.

N. C., Durham—Duke Hospital and Medical School, fireproof, nurses home, to Duke Constr. Co., c/o A. C. Lee, ch. engr., Durham. $300,000.

Oklahoma—State Bd. Affairs, Capitol Bldg., Oklahoma City, general contract, heating, plumbing, wiring 2 story, basement, 32 x 145 ft. men's ward building brick, and 2 story, basement, women's ward building, brick, stone, rein.-con., at Institution for Feeble Minded, Enid, to McMillen Constr. Co., Enid. Est. $60,000 each; general contract, 1 story, basement, 61 x 73 ft. administration building and 2 story, basement, 34 x 112 ft. nurses' home, both rein.-con., brick, stone, at Western Oklahoma Tuberculosis Sanitarium at Clinton, to Tankersley Constr. Co., Cotton Grain Exch. Bldg., Oklahoma City, est. $50,000 and $75,000 respectively; general contract 1 story, 50 x 127 ft. dining hall, 1 story, basement, 51 x 90 ft., 1 story, basement, 40 x 110 ft. industrial building, 2 story, basement, 40 x 71 ft. girls' dormitory, 2 story, basement, 40 x 71 ft. boys' dormitory, all rein.-con., brick, stone, at Taft, to Underhill Constr. Co., Braniff Bldg., Oklahoma City, est. $125,000—general contract 54 x 128 ft. rein.-con., stone industrial building at Sulphur, to G. C. Frier, Sulphur, est. $85,000; general and wiring contracts 1 and 2 story, basement, rein-con., brick, stone power plant and 2 story, basement rein.-con., brick stone hospital at Supply, to Charles Dunning Supply Co., 420½ North Hudson St., Oklahoma City, est. $85,000 and $125,000 respectively. Total est., $665,000. Noted July 23.

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CHURCHES

PROPOSED WORK

Mass., Walpole—United Church of Walpole, L. C. Schroeder, pastor, plans by Perry, Shaw & Henburn, 141 Milk St., Boston, 1 story, basement, brick, stone, Common St. $200,000. Noted Sept. 3.

N. J., Newark—Owner, c/o H. J. Weiler, archt., 40 Romaine St., sketches 2 story, basement, brick, steel, plain found. $150,000.

N. J., Newark—Owner, c/o E. Gerber, archt., 364 White St., Orange, 3 story, basement, 98 x 100 ft., brick, steel synagogue. $150,000. **Maturity in November.** Noted Aug. 6.

N. J., Pleasantville — Epiphany Lutheran Church, E. A. Libo, pastor, will not build 2 story, basement, brick, steel church, parish hall, Ansley Park. $150,000. Project abandoned. Noted June 11.

BID ASKED

Wis., Marinette—First Trinity Lutheran Church, c/o H. C. Westphal, pastor, 1509 Thomas St., taking bids 2 story, 85 x 140 ft., brick, rein.-con., plain found. C. John, 929 North Jackson St., Milwaukee, arch. Noted Sept. 10.

CONTRACTS AWARDED

Mass., Boston—New Old South Church, F. D. Putnam, trustee, 1014 Statler Bldg., altering and constructing 3 story, basement, brick parish house addition, plain found., to Casper Ranger Constr. Co., 137 Newbury St., est. $150,000; heating, to R. H. Baker Co., Inc., 238 Main St., Cambridge, plumbing, to Cox & Johnson, 257 Bway., Boston, electrical work, to E. C. Lewis, Inc., 121 Federal St., Boston, est. $25,000. Noted Sept. 3.

Mass., Roxbury — St. Cyprian's Episcopal Church, D. L. Ferguson, Tremont St., 3 story, basement, brick parish house, plain found., 1075 Tremont St., to W. J. Coumans, 12 Church St., Watertown. Est. $155,000.

Pa., Pittsburgh—J. L. Stuart, constr. supt. Oliver Bldg., excavation and found. contracts 1 and 3 story, basement, granite, limestone, Gothic type church, parish house, rectory for East Liberty Presbyterian Church, C. A. Fisher, in charge building com., 503 Highland Ave., to E. A. Wehr, 626 Highland Bldg., $150,000. Noted Sept. 3.

SCHOOLS

PROPOSED WORK

Calif., Eldridge—State of California, Capitol Bldg., Sacramento, plans by Powers & Ahnden, 605 Market St., San Francisco, 1 story, rein.-con., tile school and gymnasium extension, at Sonoma State Home. $150,000.

Conn., New London—City, E. Spitz, chn. Special Comn., new School Pequot Dist. $150,000. Architect not appointed.

Ill., Monmouth—Monmouth College, D. M. McMichael, bus. mgr., William Stetson Memorial Fine Arts Building, 2 story, basement, concrete, brick, stone, Bway. $200,000. Project postponed for a few years. Noted Nov. 13.

Mass., New Bedford—Mt. Carmel Roman Catholic Parish, A. P. Vierira, pastor, 250 Bonney St., plans by H. Fallows, 131-a Stewart St., Fall River, and soon takes bids 2 story, basement, brick, parochial grade school, Rivet and Bonney Sts. $150,000. Noted Feb. 19.

Mass., Wareham—Town, B. C. Merry, chn. building com., altering and constructing high school addition, Marion Rd. $150,000. Architect not appointed.

N. H., Hanover—Town, R. Fuller, supt. schools, high school, Lebanon St. $150,000 or more. Architect not appointed.

N. J., Carlstadt—Bd. Educ., Boro Hall, 2 story, basement, brick, steel, rein.-con. grade and junior high school, Washington St. $150,000. **Maturity probably soon.**

N. J., Demarest—Bd. Educ. 2 story, basement, brick, steel, rein.-con. school. $150,000. **Maturity probably soon.**

N. J., Elizabeth—Bd. Educ., 417 South Broad St., sketches by H. B. Brady, Inc., 333 North Broad St., 3 story, basement, brick, steel, rein.-con. manual training and industrial art school. $150,000 or more. Noted Sept. 3.

N. J., Fairview—Bd. Educ. 2 story, basement, brick, steel, grade and junior high school. $150,000. Maturity probably soon.

N. J., Garfield—Owner, c/o J. D. Dynes, archt., 15 Orient Way, Rutherford, 1 story, basement, brick, steel, Sunday school and fellowship hall, Palisade Ave. $150,000. **Maturity in spring.** Noted Sept. 10.

N. J., Jersey City—Bd. Educ., Administration Bldg., bids probably in October, general contract School 38, 3 story, basement, brick, steel, $1,115,000. J. T. Rowland, Jr., 30 Journal Sq., archt.

N. J., Millburn—Bd. Educ., High School, bids in November, 2 story, basement, brick, steel school, $150,000. E. Sibley & G. Cady, 1034 Edgewood Lane, Palisade, archts. Noted Sept. 3.

N. J., Ridgefield Park—Bd. Educ., Overpeck Twp., G. Noethling, dist. clk., will not build 2 story, basement, brick school addition, Teaneck Rd. $150,000. Project abandoned. Noted Aug. 6.

N. J., River Edge—Bd. Educ. Boro Hall, revised sketches by J. L. T. Tillack, 173 Main St., Hackensack, 2 story, basement, brick, steel, Howland Ave. $200,000. Noted July 23.

N. Y., Brooklyn—Roman Diocese of Brooklyn, c/o H. V. Murphy, archt., 208 Livingston St., will not build school addition 73rd St and 15th Ave. Project abandoned. Noted Aug. 20.

Tenn., Knoxville—University of Tennessee, S. Johnson, secy., c/o J. J. Walker, South College, revised plans by Barber & McMurray, General Bldg., gymnasium and physical education building. $250,000 or more. Noted Sept. 10.

Ont., Kitchener—Bd. Educ., H. W. Brown, secy., 787 King St. W., 2 new wings to Collegiate Institute and Vocational School, $200,000. Architect not appointed.

Ont., London—Bd. Educ. Technical School addition, $250,000; also 8 room addition to Ryerson Public School, $150,000. L. E. Carrothers, Bd. Educ. Bldg., archt. Noted Jan. 22.

Ont., Niagara Falls—Bd. Educ. plans by V. C. Thomas, 481 Queen St., new high school. $150,000. Noted Nov. 13.

Ont., Ottawa—Separate School Comn., 3 story, fireproof, St. Patrick St. $250,000.

Que., Aylmer—Jesuit Fathers, Bleury St., Montreal, college, Aylmer Rd. $350,000.

BIDS ASKED

Conn., Bridgeport—City, Bd. Educ., taking bids 2 story, basement, brick school, Boston Terrace, Northeast Sect., J. W. Northrop, 211 State St., archt. Noted Sept. 10.

Del., Dover—Sept. 27, by Bd. Trustees State College for Colored Students, H. V. Holomery, supt., State School Building Comn., 3 story, basement, 75 x 140 irregular sized brick, steel, rein.-con. dining hall, plain found., State College. $150,000. Guilbert & Betelle, 20 Branford Pl., Newark, N. J., archts.

Ill., Peoria—Sept. 26, by Bd. Educ., Monroe St., Theodore Roosevelt Junior High School, 3 story, 216 x 266 ft. center building with 102 x 176 ft. open court in middle, 102 x 146 ft. gymnasium, 75 x 144 ft. auditorium, 64 x 82 ft. boiler room, also shops, kitchen, cafeteria, Eckley St. $600,000. Hewitt, Emerson & Gregg, Peoria Life Insurance Bldg., archts.

Ind., Tangier—Sept. 19, by School Comrs., brick, steel, stone grade and high school. $150,000. H. L. Fillinger, Dana, archt.

Md., Garrett Park—Georgetown Preparatory School, R. S. Lloyd, supervisor, taking bids 1 story, basement, 45 x 120 ft. and 2 wings, brick, stone chapel. To exceed $150,000. Maginnis & Walsh, Statler Bldg., Boston, Mass., archts.

N. H., Exeter—Sept. 18, by Phillips Exeter Academy, L. Perry, and Cram & Ferguson, archts., 248 Boylston St., Boston, Mass., 3 story, basement, brick, steel inn, plain found., academy grounds. $150,000. Noted Aug. 13, under "Contracts Awarded."

N. J., Franklin Park—Sept. 28, by Bd. Educ., Franklin Twp., R. D. 1, Princeton, general contract 2 story, basement, brick, steel, Pine Grove Ave. $150,000. J. N. Pierson & Son, 198 Jefferson St., Perth Amboy, archts.

N. Y., Albany—Sept. 24, by Commissioner Educ., State Educ. Bldg., altering Gideon Hawley Building, New York State College for Teachers; adv. E. N.-R. Sept. 17.

N. Y., Ithaca—Oct. 1, by Commissioner Education, State Educ. Bldg., Albany, agricultural economics building, New York State College of Agriculture, Cornell University.; adv. E. N.-R. Sept. 17.

N. Y., Sonyea—Sept. 30, by Commissioner Dpt. Mental Hygiene, State Office Bldg., chapel, Craig Colony; adv. E. N.-R. Sept. 17.

Tenn., Nashville — Sept. 29, by State Bd. Educ., Senate Chamber, State Capitol Bldg., P. L. Harned, chn., Women's Vocational Building, Men's Agricultural and Industrial Building. Marr & Holman, 702 Stahlman Bldg., archts. Noted Feb. 26.

CONTRACTS AWARDED

Conn., Middlebury—Town School Bd., 2 story, basement, brick, stone, plain found., Main St., to Judd & Bronson, Inc., Middlebury. Est. $150,000. Noted Aug. 27.

La., New Orleans—Wogan & Bernard, archts., Canal Bank Bldg., Institution Group, 2 story, basement, rein.-con., brick, limestone, pile found. for Sisters of Blessed Sacrament, to George Glover Co., Whitney Bank Bldg., $378,023. Noted Aug. 6.

Mass., Boston—Dpt. School Buildings, 4 story, basement, brick, steel, plain found., Hancock Dist., to Rugo Constr. Co., 80 Boylston St. $194,000.

Mass., Waltham—City, at office P. J. Duane, mayor, 2 story, basement, 80 x 100 ft., brick school to M. F. Stankard & Son, 28 Howard St. Est. $150,000. Noted Aug. 27.

Mich., Wakefield—Bd. Educ., 2 story, brick, steel, rein.-con., stone, gymnasium, plain found., to F. Tomlinson, Ashland, $143,420.

N. Y., Ithaca—Commissioner Educ., Education Bldg., Albany, Home Economics Building, New York State College of Home Economics, Cornell University, to M. H. Long, Allentown, Pa., $709,000 heating to F. Bradt, 113 Oakwood Ave., Syracuse, $88,840; sanitary work to A. J. Eckert, 103 North Lake St., Albany, $51,500; electrical work, to J. P. Morrissey, 405 Lexington Ave., New York, $62,500; elevators, to A. B. See, 52 Vesey St., New York, $23,925. Grand total, $935,765. Noted July 30.

N. Y., Oneonta—Commissioner Dpt. Educ., Education Bldg., Albany, general contract normal school at New York State Normal School, to W. F. Hendrich, 241 Euclid Ave., Cleveland, O., $257,801; heating, to Huffman Wolfe, 11 Pittsburgh St., Phila., Pa., $48,500; sanitary work, to Bareham & McFarland, 136 North St.,

Schools (Continued)
Rochester, $14,872; electrical work, to Langdon & Hughes, 246 Elizabeth St., Utica, $10,900. Grand total, $332,072. Noted July 30.

N. D., Grand Forks—Bd. Educ., W. P. Roglie, secy., general contract 2 story, basement, 120 x 200 ft., rein.-con., brick, stone, to Thorvaldson-Johnson, Grand Forks, $113,500. Est. $150,000. Noted Aug. 20.

Pa., Pottsville—T. T. Daddow, secy, Bd. Educ., 5th and Norwegian Sts., general contract 3 and 4 story, basement, 246 x 401 ft., rein.-con., brick, steel high school, to I. Reindollar & Son, 936 Linden St., Work, $560,269; electric wiring, to A. C. Hassler, 121 North Market St., $42,183; heating, to Corbet Bros., 151 North 5th St., Reading, $98,490; plumbing, to Freyn Bros., 1028 North Illinois St., Indianapolis, Ind., $31,009. Grand total $731,951. Noted Aug. 13.

Tex., Galveston—Independent School Dist., c/o Z. L. White, chn. Building Comn., 2 story, brick, hollow tile school, to J. W. Zempter & Co., on base bid; plumbing, heating, ventilating to H. I. Davis, Galveston, $30,000; electric wiring, to Eugene Ashe Electric Co., 505 Jones St. $4,840 (tentative award). Est. $200,000. Noted Aug. 20.

THEATRES

PROPOSED WORK

Mass., New Bedford—Zeiterion Realty Co., 674 Purchase St., sketches by F. A. Walker, 1st Natl. Bank Bldg., remodeling 1 story, basement, brick theatre, Union St. $150,000.

BIDS ASKED

N. J., Englewood—M. and R. Realty Co., S. Lippmann & L. Gottlieb, 491 East 27th St., Paterson, bids late in October, general and separate contracts 2 story, basement, brick, steel, theatre, office, store, 16 West Palisade Ave. $150,000. E. DeRosa, 18 East 41st St., New York, archt. Noted Aug. 12.

Tenn., Nashville—Marr & Holman, archts., Stahlman Bldg., bids early in October, superstructure and erecting steel for 12 story, basement, black polished granite, white limestone theatre, 2,500 seating capacity, incl. office, stores, garage, 70 ft. marquise, Church St. and 6th Ave., for Warner Bros. Pictures, Inc., 321 West 44th St., New York. $1,500,000. Noted June 4.

CONTRACTS AWARDED

Mass., Brookline (br. Boston) — Paramount Publix Theatres, Paramount Bldg., New York, theatre, to F. J. Van Etten, 250 Stuart St., Boston. Noted July 2.

BANKS

PROPOSED WORK

N. Y., Brooklyn—Brevoort Savings Bank, 522 Nostrand Ave., bids latter part month, bank addition. Halsey, McCormick & Helmer, 286 5th Ave., New York, archts. Noted July 9.

OFFICES

PROPOSED WORK

Mich., Ionia—Ionia State Hospital, State Administrative Bd., Lansing, plans by Colton, Knecht, McCarty & Thebaud, Grand Rapids, 3 and 4 story, basement, brick, rein.-con., stone, steel hospital addition, plain found. $300,000.

Mo., St. Louis—City, c/o Bd. P. Serv. City Hall, bids in fall, 6 story central building and 2 war wings each 5 story, and service building, incl. kitchen, laundry, and shops in rear. Whitter St., Kennerly, Ferdinand and Goode Aves. $800,000. A. Osburg, city archt. L. R. Bowen, city engr. Noted Dec. 4.

N. Y., Neponsit Beach (mail Far Rockaway) —Dpt. Hospitals, Municipal Bldg., New York, bids about October, general contract 4 story, 35 x 125 ft. nurses home, $250,000. Dodge & Morrison, 160 Pearl St., New York, archts.

Ont., Toronto—Hydro-electric Power Comn. of Ontario, 190 University Ave., plans by Sproatt & Ralph, 1162 Bay St., 14 to 17 story basement, rein.-con., brick, structural steel addition. $2,000,000.

Ont., Toronto—North American Life Assurance Co., 112 King St. W., soon takes bids 7 story (ultimately 15 story), 122 x 200 ft., stone, structural steel office, King St. Total, $1,500,000. Marani, Lawson & Morris, 38 Bloor St. W., archts. G. Wallace, 68 Glenwood Ave., structural engr. Edwart, Armer & Byam, Excelsior Life Bldg., mechanical engrs. Noted May 21.

BIDS ASKED

N. J., Newark—Owner, c/o J. B. Acoccella, archt., 9 Clinton St, bids about Nov. 15, general contract 2 story, basement, brick, steel office, store, $150,000. Noted Sept. 3.

N. J., Weehawken—Sept. 22, by New York Central R.R. Co., F. B. Freeman, ch. engr., 460 Lexington Ave., New York, general contract 2 story, basement, brick, steel office, Pier K. $150,000.

Tenn., Nashville—See "Theatres."

CONTRACTS AWARDED

Ia., Spencer—Building Corp., c/o J. O. Birdsall & W. Cornwall, rebuilding McAllister Building, 2 story, basement, 118 x 125 ft., rein.-con., brick, stone, to Spencer Constr. Co., Spencer. Noted July 30.

Mass., Brockton—See "Stores."

Mass., Winthrop—Winthrop Community Hospital, E. P. Whittier, chn. building com., 4 story, basement, 40 x 180 ft., brick, stone, plain found., Lincoln St., to O. H. Drisco & Son, 46 Cornhill, Boston. Est. $175,000.

STORES

PROPOSED WORK

Mass., Brockton—F. W. Woolworth Co., Park Sq. Bldg., Boston, 3 story, basement, brick, steel store, offices, plain found., to C. A. Batson, 26 Arlington St. Est. $150,000. Noted Sept. 3.

N. J., East Orange—Mahnkan & Schultz, archts., 256 Summit Ave., Union City, bids in April, 2 story, basement, brick, steel store, office, Central Ave., for M. Keating, c/o architect. $150,000. Noted Aug. 6.

N. Y., New York—W. Hagedon, 1896 1st Ave., plans by C. Schafer, 332 East 149th St., 3 story, 110 x 164 ft. stores, office, Valentine Ave. and Fordham Rd. $300,000.

BIDS ASKED

N. J., East Orange—Siegler & Greenberg, archts., 164 Market St., Newark, bids about Oct. 1, general contract 2 story, basement, brick, steel store, office, apartment, Dodd and Prospect Sts., for I. Bachman, c/o architect. $150,000. Noted Sept. 10.

N. J., Newark—See "Contracts Awarded."

N. J., Union City—P. L. Schultz, archt., 256 Summit Ave., bids about Oct. 15, general contract on revised plans 3 story, basement, brick, steel store, office, 169-73 Summit Ave., for S. Slatkin, 17 Oak Pl., Weehawken. $150,000. F. W. Woolworth Co., Woolworth Bldg., New York, lessee. Noted July 30.

CONTRACTS AWARDED

Conn., Greenwich—Franklin Simon & Co., 414 5th Ave., New York, owner and lessee, 3 story, department store, Boston Post Rd. and Deerfield Dr., to Leddy & Moore, 70 West 40th St., New York. Est. exceeds $200,000.

N. J., Newark—Psichos Corp., c/o M. Mancusi-Ungaro, archt., 207 Market St., 2 story, basement, brick, steel store, apartment, Roseville St. and 1st Ave., separate contracts. $150,000.

PUBLIC

PROPOSED WORK

Ill., Quincy—HOME—State of Illinois, Capitol Bldg., Springfield, sketches by C. H. Hammond, supervy. archt., c/o owner, 2 or 3 story home at State Soldiers and Sailors Home. $200,000. Maturity in late fall.

N. J., Jersey City—ART MUSEUM—Bd. City Comrs., City Hall, will not build 2 story, basement, brick, steel art museum. $150,000. Project abandoned. Noted July 23.

N. J., Rahway—CITY HALL—Bd. City Council, T. J. Loughlin, pres., 118 Main St., 2 story, basement brick, steel city hall. $150,000. Architect not appointed. Project in abeyance. Noted Aug. 6.

N. J., Roselle—LIBRARY—Bd. Trustees Public Library, will not build 1 story, basement, brick, steel, Chestnut St. and 24th Ave. $150,000. Project abandoned. Noted Aug. 27.

N. C., Waynesville—COURT HOUSE—Comrs. Haywood Co., c/o Chairman, 3 story, basement, rein.-con., steel, brick, to Southeastern Constr. Co., Charlotte, $230,000. Noted July 9.

N. D., Bismarck—CAPITOL—State Bd. Control plans by J. Bel deRemer, Grand Forks, and W. F. Kurke, Fargo, rebuilding state capitol. $2,000,000. Holabird & Root, 333 North Michigan Ave., Chicago, Ill., assoc. archts. Noted Apr. 2.

Okla., Pawnee—COURT HOUSE—Bd. Comrs. Pawnee Co., 3 story, basement, 80 x 100 ft., Bedford stone. $150,000. Plans by Smith & Senter, Philtower Bldg., Tulsa. Noted Sept. 10.

BIDS ASKED

Mass., Cambridge—COURT HOUSE—Sept. 11 (extended date), by Middlesex Co., W. C. Wardwell, chn. comrs., 3 and 4 story, basement, brick, stone, steel, plain found., East Cambridge. $200,000. C. R. Greco, 11 Beacon St., Boston, arch. Noted Sept. 3.

N. J., East Orange—FIRE HEADQUARTERS —Bd. City Council, City Hall, bids about Nov. 1, general contract 2 story, basement, brick, steel. Main St. $150,000. W. F. Bower, 437 Main St., archt. Noted Aug. 6.

N. J., Maplewood—MUNICIPAL—Sept. 19, by Twp., Com., Municipal Bldg., 1 and 2 story, basement, brick, steel, Valley St. between Oakview Ave. and Parker Rd. $200,000. Guilbert & Betelle, 20 Branford Pl., Newark, archts. Noted Sept. 10.

N. Y., Albany—POLICE STATION—Sept. 21, by Bd. Contr. & Supply, P. J. Manville, secy., for 1st Precinct Police Station, 3 story, basement, 60 x 110 ft., plain found., Clinton Ave. $150,000.

Que., Ste. Anne de Bellevue—PUBLIC—Sept. 22, by Dpt. P. Wks., Ottawa, Ont., N. Desjardins, secy., public building.

CONTRACTS AWARDED

Minnesota—COTTAGES—State Comn. of Administration and Finance, Capitol Bldg., St. Paul, two 2 story, basement cottages, also power plant, rein.-con., brick, stone at State College for Epileptics at Cambridge, to W. W. Magee, Commercial Bank Bldg., St. Paul. Est. $202,000 for former $161,000 for latter buildings. Noted Aug. 6.

N. Y., New York—COURT HOUSE—H. Bruckner, pres. Bronx Boro, Crotona Park, 3rd and Tremont Aves., general contract Bronx County Building, to William Kennedy Co., 215 Montague St., Brooklyn, $4,747,397; plumbing, to J. D. Duffy, Inc., 200 East 138th St., $198,500; heating, to Dierkes Heating Co., 208 East 31st St., $350,987; electrical work, to Lord Electric Co., 105 West 40th St., $142,700; elevators, to A. B. See Elevator Co., 52 Vesey St., $349,500. Grand total $5,795,084. Noted July 30.

R. I., Cranston (mail Providence)—REFORMATORY—State, Dpt. P. Welfare, State House, Providence, 3 story, basement, 40 x 150 ft., and 80 x 80 ft., brick, steel, plain found., to A. F. Smiley Constr. Co., Oak Hall Bldg., Pawtucket, $243,827; heating, to Taylor Heating Co., 714 Broad St., Providence, $17,925; plumbing, to H. L. Graham & Sons, 60 Exchange St., Pawtucket, $22,406; electrical work, to New England Machine & Electric Co., 77 Bayley St., Pawtucket, $4,889. Grand total $289,137. Noted Aug. 13.

W. Va., Clarksburg — COURT HOUSE — Bd. Comrs. Harrison Co., 3 story basement, stone, steel, concrete, to Hutter Constr. Co., Fond Du Lac, Wis. Est. $400,000. Noted Aug. 20.

Ont., Toronto—FIRE STATION, ETC.—City Property Dpt., fire halls, motor repair shop, $85,000; new halls, Montgomery Ave., $36,000; Gerrard St. E., $43,000; Keele St., $43,000; general improvements, $5,884; new police stations at Montgomery Ave., $86,000; Keele St., $85,000; driveway at Ossington Ave. Police Station, $1,500. Work to be done partly by day labor and partly by contract. R. C. Harris, City Hall, engr.

UNCLASSIFIED

PROPOSED WORK

Calif., San Jose—DEPOT—Southern Pacific R.R. Co., 65 Market St., San Francisco, G. W. Boschke, ch. engr., brick, steel passenger and freight depot. $150,000. Private plans.

N. J., Newark—MERCANTILE—J. F. Collins & Co., 140 Mulberry St., 4 story, basement, brick, steel, 249 Mulberry St. $150,000. General contract bids in. Project in abeyance H. J. and J. V. King, 222 Market St., archts. Noted Aug. 20.

Ont., Ottawa—WOMEN'S MEMORIAL—A. Gordon, chn. building com., women's memorial building, St. Patrick and Sussex Sts. $350,000.

BIDS ASKED

Calif., Sacramento—ORPHANAGE—H. J. Devine, archt., California State Life Bldg., taking bids 2 story, basement, rein.-con. orphanage, for St. Patricks Orphanage. $250,000.

N. J., Westwood—RAILROAD STATION—Erie R.R. Co., G. S. Fanning, ch. engr., 101 Prospect Ave. S.W., Cleveland, O., taking bids general contract 2 story, basement railroad station. $150,000.

CONTRACTS AWARDED

Mass., Shrewsbury—NURSES' DORMITORY Grand Lodge of Masons, 51 Boylston St., Boston, 3 story, basement, brick, plain found., to J. H. Gray, 25 Main St., Worcester. Est. $150,000.

Industrial Buildings

FACTORIES AND MILLS

PROPOSED WORK

Calif., Ontario—FACTORY—Campbells Foods Ltd., tentative studies prepared 3 story, subbasement, rein.-con., steel building $100,000. $65,000 worth of machinery to be installed; also completed plans remodeling factory, South Sultana Ave., $35,000. Eng. Dpt. of Owners, engrs.

Conn., Bridgeport — FACTORY — Bridgeport Window Shade Co., 197 Stratford Ave., plans by A. Pokras, Community Bldg., Fairfield, 2 story, 62 x 100 ft., brick, cast stone, tile, Fairfield Ave. $40,000.

Conn., New Haven—FACTORY—Berger Bros., 35 Derby Ave., soon lets contract 5 story, 40 x 120 ft., brick, concrete surgical corset factory, Derby Ave. $75,000. D. Orr, 956 Chapel St., archt. Noted Aug. 20.

Ill., Decatur—PLANT—Flint Eaton Co., 148 North Franklin St., G. R. Flint, pres., plans by Brooks, Bramhall & Dague, Natl. Bank Bldg., 2 story, basement, pharmaceutical chemists plant and office, North Water St. $50,000.

Ill., South Chicago (sta. Chicago)—PLANT —General Mills, Inc., 200 Chamber of Commerce Bldg., Minneapolis, Minn., J. F. Bell, pres., sketches addition and equipment cereal package foods plant. To exceed $100,000.

Mass., Dartmouth—SAUSAGE FACTORY—J. Correa & Sons, 18 Puritan Rd., plans by F. A. Rousseau, 271 Union St., New Bedford, 1 story, concrete block, South Dartmouth Sect. $40,000.

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Factories and Mills (Continued)

Mass., South Dartmouth (br. New Bedford)—SAUSAGE FACTORY—J. Correa & Sons, 18 Puritan Rd., plans by F. A. Rousseau, 271 Union St., New Bedford, 1 story, concrete, Puritan Rd.

N. J., Maplewood—GOLF CLUB FACTORY—Kroydon Co., Burnet Ave., will not build 1 story, basement, brick, steel addition. $40,000. Project abandoned. Noted July 9.

N. J., Newark—REFINERY PLANT—Emile Snyder, Inc., 306 Smith St., 2 story, basement, brick, steel, 298-306 South St. $140,000. Architect not appointed. **Maturity probably in November.** Noted Aug. 27.

N. J., South Amboy—FACTORY—United Lead Co., Maurer, plans factory. $40,000. **Maturity probably soon.** Architect not appointed.

N. Y., New York—PLANT—Baird Television Corp., 145 West 45th St., plant and equipment in or near city. To exceed $40,000. Architect not appointed.

N. Y., New York—LAUNDRY—Consolidated Laundries, 122 East 42nd St., altering 50 x 153 ft. laundry and garage, Wilkins Ave. and 170th St. $60,000. A. Schwartz, 103 Park Ave., archt.

N. Y., New York—FACTORY—Hub Cleaning & Sterilizing Co., 212 East 148th St., plans by R. Shutkind, 147 4th Ave., 25 x 61 ft., cleaning and sterilizing plant addition, 148th St. and Park Ave. $40,000, incl. equipment.

N. Y., New York—FACTORY—Kohler & Campbell, 601 West 50th St., altering factory, 627 West 50th St. $40,000. Project in abeyance. Ross & McNeil, 274 Madison Ave., archts. Noted Sept. 3.

Okla., Muskogee — ICE PLANT and COLD STORAGE — Community Ice & Produce Co., Sulphur Springs, Tex., sketches 2 story, basement, rein.-con., brick. $50,000.

Tex., Midland—FERTILIZER PLANT—Evercyclic Corp., Midland, plant to manufacture fertilizer from sulphur gas extracted from gas field in Crane Co., 5 ton daily capacity. Private plans.

Va., Blackstone—TEXTILE MILL—Blackstone Wearing Co., soon lets contract 1 story addition, also equipment. To exceed $40,000.

BIDS ASKED

Mo., Dixfield — FACTORY—Berst-Foster-Dixfield Co., F. W. Smith, mgr., West Peru, taking bids 3 story, 105 x 200 ft., brick, steel, plain found. To exceed $40,000. H. F. Hallock, Oswego, N. H., archt. Noted Mar. 12.

Mo., Ellis—ASPHALT PLANT—See "Contracts Awarded."

N. Y., New York—PRINTING and PUBLISHING PLANT—Sept. 18, by Lockwood Greene & Co., archts. and engrs., 100 East 42nd St., printing and publishing plant, 42 Broad St., for Dow Jones Publishing Co., 44 Broad St. $500,000. Noted Aug. 27.

Tex., Pettus—REFINING PLANT IMPROVEMENTS—See "Contracts Awarded."

CONTRACTS AWARDED

Calif., Los Angeles—DAIRY—Valley Dairy Co., 548 Colyton St., 2 story, 65 x 200 ft. rein.-con., Fletcher Ave., to T. R. Cooper & Co., Western Pacific Bldg., $65,000.

Fla., Lake Wales—PACKING PLANT—Lake Wales Citrus Growers Assn., c/o W. A. Varn, chn. building comn., Lake Wales, general contract 1 story, basement, 205 x 305 ft., brick, structural steel, to G. A. Miller, Inc., Petteway Bldg., Tampa. Est. $150,000.

Ky., Bowling Green — OIL REFINERY — Bowling Green Refineries Co., stills, etc., for oil refinery, to Leader Iron Wks., Decatur, Ill. Est. $100,000. Found. in materials purchased.

Ill., Bellwood—MANUFACTURING PLANT—Jefferson Electric Co., 15th and Laflin Sts., Chicago, plant, to Austin Co., 16112 Euclid Ave., Cleveland, O. Est. $500,000.

Ia., Dubuque — BAKERY — Trausch Baking Co., 1120-1154 Iowa St., general contract 1 story, rein.-con., brick bakery; also remodeling 2 buildings, Main St., to A. Zwack, 1301 Central St.; heating and plumbing, to Mullen Bros. & Co., Dubuque; electric wiring, to United Electric Co. Est. $80,000.

Mass., Boston—LAUNDRY—Chas. Bonanno Laundry & Supply Co., 95 Albany St., 2 story, basement, brick, to Tredennick-Billings Co., 10 High St. Est. $40,000. Noted Aug. 27.

Mass., Gloucester — LAUNDRY — G. M. I. Laundry Co., J. Connor, 12 Burnham St., rebuilding 2 story, brick, stone, concrete found., recently destroyed by fire, to J. Anderson, Rockport. Est. $45,000. Noted Sept. 10.

Mich., Ecorse — FACTORY — Murray Body Corp., Clay Ave., Detroit, 1 story, 100 x 300 ft., brick, steel, concrete, plain found., to Otto Misch, Co., 159 East Columbia St., Detroit. Est. $75,000.

Mo., Ellis—ASPHALT PLANT—H. D. Barndollar & W. L. Kepner, Joplin, will build asphalt manufacturing plant, local labor. $100,000. Private plans.

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Mo., St. Louis—PLANT — Pittsburgh-Erie Saw Corp., 704 South 4th St., 1 and 2 story, basement, rein.-con. plant on 50 x 254 ft. site, Tower Grove St., to W. H. and N. Cunliff Co., 3327 Lindell Blvd., Est. $80,000.

N. J., Absecon—FACTORY—Metal Edge Fiber Products Co., general contract 2 story, basement, brick, steel, 50 x 150 ft., brick, steel, Ohio Ave. between Mill and New Rds., to Brown Bros., Atlantic City. Est. $40,000.

N. Y., Brooklyn — LAUNDRY — K. N. K. Laundry, C. Batelotti, pres., altering laundry, 61st St. and West 12th Ave., to Herbran Braaten, 189 Montague St. Est. $40,000. Noted Sept. 3.

N. Y., Brooklyn—LAUNDRY—State Laundry, Inc., Myrtle and Nostrand Aves., altering laundry, to A. B. Murphy Constr. Co., Jamaica, and c/o owner. $40,000. Noted Aug. 6.

Tenn., Chattanooga—HOSIERY MILL—Davenport Hosiery Mills, 906 Garard Ave., 1 story, 92 x 228 ft., rein.-con., steel brick addition, to Capitol Constr. Co., Standard Bldg., Atlanta, Ga. Noted Aug. 24.

Tex., Edcouch—ICE PLANT—R. E. Ewing, Santa Rosa, 1 story, steel, stucco, rein.-con. found., to C. C. Daniels, Santa Rosa. Est, $80,000.

Tex., Pettus—REFINING PLANT IMPROVEMENTS—Phoenix Refining Co., Beeville, increasing refining plant capacity by 40%, incl. new stills, tower, most of work by day labor under supervision of owners. $70,000. Private plans.

W. Va., Newell—FACTORY—Edwin M. Knowles China Co., electric tunnel kiln at new plant, to Electric Furnace Co., Salem, O., $50,000; steel castings, other metal parts, to Patterson Fdry. & Machine Co.

GARAGES

PROPOSED WORK

Mass., Brockton—Packard Car Agency, D. W. Parkard, 350 Waren Ave., plans by J. W. Beal Sons, 185 Devonshire St., Boston, 1 story, 100 x 200 ft. brick, steel, concrete service and sales garage. 1 Warren Ave. $60,000.

N. Y., Jamaica—Kalbert Bros., 26 Court St., Brooklyn, 2 story service garage, store, Jamaica Ave. and 149th St. $100,000.

N. Y., Long Island City—Queensboro Dairy, 35 12th Ave., Astoria, will award general contract about Oct. 1, garage, office, 41st St. and 35th Ave. $40,000. Bids in. R. Shulkind, archt. Noted Aug. 27.

N. Y., New York—Corporation c/o J. Irving, 332 East 149th St., sketches by C. Schaefer, Jr., 332 East 149th St., 1 story, 103 x 116 ft. service garage, Westchester and Wilkinson Aves. $40,000.

N. Y., New York—REPAIR SHOP, etc.—J. M. Horton Ice Cream Co., 205 East 24th St., sketches by J. E. Ross, archt. and engr., 25 West 43rd St., 199 x 220 ft. repair shop, garage, 110 East 131st St. $95,000.

BIDS ASKED

Me., Augusta—L. D. Flint, 5 Lincoln St., taking bids 1 story, concrete, steel, brick service garage, plain found., State St. $40,000. Edward Sales Co., 443 Portland St., Portland, archts.

Mich., Detroit—Chevrolet Motor Co., Holbrook and Dequindre Sts., 1 story, brick, steel factory for apprentice shop at automobile plant, plain found., Holbrook Ave., to H. G. Christman-Burke Co., 1010 Fisher Bldg. Est. $55,000.

N. Y., Comstock—Sept. 24, by Commissioner Dpt. Correction, State Office Bldg., Albany, garage, blacksmith and machine shop buildings, Great Meadow Prison; adv. E. N.-R. Sept. 17.

N. Y., New York—See "Contracts Awarded."

Tenn., Nashville—See "Theatres."

CONTRACTS AWARDED

Calif., Los Angeles — W. Richards, archt., Architects Bldg., 2 story, basement, 100 x 150 ft., rein.-con. garage and auto sales room, South Grand Ave., to Myers Bros., 3407 San Fernando Rd., for Montgomery Properties, Inc., Pacific Finance Bldg., exceeds $150,000.

N. Y., New York—S. Cincelli, 2393 Arthur Ave., 1 story, 90 x 110 ft., service garage, Hoffman and 184th Sts., separate contracts, $40,000. M. W. DelGandio, 545 5th Ave., archts. Noted Aug. 19.

N. Y., New York—G. W. Plunket, 205 East 85th Street, altering 3 story, stable to service garage, to E. J. Marx, 3980 White Plains Ave. Est. $50,000. Noted Sept. 10.

N. Y., New York—Two Hundred Twenty West 61st St. Corp., L. Irish, 60 East 42nd St., 100 x 250 ft. service garage, to I. Langner & Son, 60 East 42nd St. Est. $75,000. Noted Sept. 3.

N. Y., Syracuse—Syracuse Lighting Co., 421 South Warren St., 3 story, 103 x 227 ft. garage, Erie Blvd., Franklin and Wallace Sts., to Dawson Bros., Union Bldg. Est. $200,000.

SHOPS AND FOUNDRIES

PROPOSED WORK

Ont., Toronto—See "Public."

CONTRACTS AWARDED

Mass., Worcester—SHOP—City, J. H. Brooks, Jr., supt., 3 story, 50 x 175 ft., brick, steel, East Worcester St., to A. J. Gendron, 114 Coburn Ave., $112,395. Noted Aug. 13.

POWER PLANTS

PROPOSED WORK

N. Y., Brooklyn—Kings County Lighting Co., 6740 4th Ave., plans by M. T. Ketz, 50 Church St., New York, 2 story exhauster room and plant addition, 1st Ave. and 54th St. $45,000.

BIDS ASKED

Ind., South Bend—A. Kahn, Inc., archts. and engr., 1000 Marquette Bldg., Detroit, Mich., taking bids 2 story, 80 ft. high, 52 x 100 ft., rein.-con., brick, steel, stone power plant, incl. stack 200 ft. high, 500 ton coal bunkers, coal and ash handling equipment, boiler and equipment, for Notre Dame College.

Ia., Lenox—Oct. 6 (extended date), by L. B. Carruthers, city clk., 38 x 52 ft. concrete, brick power plant, 20 ft. high, incl. 2 Diesel engines, switchboard, accessories, distribution system, for City. $65,000—$85,000. Noted July 23.

CONTRACTS AWARDED

Ind., Huntingburg—City, general contract additions, alterations brick, steel power plant, incl. boiler, stoker, radial stack, to W. A. Armstrong, Somerville. Est. $40,000.

Ind., South Bend—Notre Dame University, rein.-con., brick, tile steel power plant addition, also rein.-con. tunnel, to T. L. Hickey, 121 North Hill St. Est. $65,000. Noted Sept. 10.

La., Lake Mills—City Clerk, 1 story, 38 x 52 ft., concrete, tile power plant, incl. 2 Diesel engines, generating units, complete distribution system, to Fairbanks-Morse Co., 9th and Harney Sts., Omaha, Neb. $83,135. Noted Aug. 14.

Mass., Gloucester—Addison Gilbert Hospital, c/o Phillips & Holloran, archts., 191 Main St., 1 story, concrete boiler house, Washington St., to R. E. Runels Constr. Co., 24 Merrinick St.,

Mass., North Wilbraham—Collins Mfg. Co., 56 Suffolk St., Holyoke, 1 story, brick, steel power plant, Main St., to Casper Ranger Constr. Co., 6 Newton St., Holyoke. Est. $50,000. Noted Aug. 27.

N. Y., Oxford—Superintendent Standards & Purchase, Executive Dpt., Capitol Bld., Albany, installing generators and electric service connections, New York State Women's Relief Corps Home, to F. A. Mott Co., 196 Chestnut St., Rochester, $30,900. Noted July 30.

Wis., Gresham — City, C. J. Elbert, clk., 1 story, 60 x 90 ft. rein.-con., brick, steel hydro-electric plant, to Ford Constr. Co., 911 South Jackson St., Janesville.

Ontario — Abitibi Power & Paper Co., 88 University Ave., Toronto, equipment in connection with hydro-electric development on Abitibi River at Abitibi Canyon, 100 ton crane (electric), to Dominion Bridge Co., 1139 Shaw St., Toronto; 114 mi. steel transmission line towers, to Canadian Bridge Co., Ltd., Walker Rd., Walkerville. Noted Aug. 20, under "Contracts Awarded."

WAREHOUSES

PROPOSED WORK

Calif., San Jose—See "Buildings Unclassified."

N. J., Newark—Wilkinson Gaddis & Co., 95 Parkhurst St., sketches by Epple & Kahrs, 15 Washington St., 5 story, basement, brick, steel, rein.-con. grocery warehouse, office. $500,000. Noted Sept. 10.

N. Y., New York—Castle Hill Estate, N. I. Sayers, in charge, 67 Liberty St., 1 story, 75 x 100 ft. storage tank, Castle Hill and Norton Aves. $40,000. Private plans.

Wis., Oshkosh—M. C. Cobhadas, 812 South Bound St., Appleton, plans by D. E. Anderson, Marquette, Mich., 2 story 46 x 100 ft. rein.-con., brick, steel cold storage warehouse, incl. elevators, refrigeration. $40,000.

BIDS ASKED

New York—See "Streets and Roads."

Pa., Wilkes-Barre — Sept. 18, by Swift Co., 6 North Market St., Boston, Mass., 2 story, basement, 100 x 200 ft., rein.-con., brick, steel warehouse, plain found. Private plans.

CONTRACTS AWARDED

Tex., Houston—W. L. Edmundson, 4920 Pease St., 140 x 700 ft., timber, brick warehouse, Dumble St. and Calhoun Rd., to D. Hall, Union Natl. Bank Bldg. $44,000.

See proposed advertising on page 70